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'*Knowledge is proud that he has learned so much,*
Wisdom is humble that he knows no more.'—COWPER.

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School Surgery.

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XI.

STRANGULATION OR SUFFOCATION, ACCIDENTAL OR SUICIDAL.

IT has occasionally happened that a boy has been accidentally hanged. Several such cases are mentioned in works on Forensic Medicine. Scott, the American diver, hung himself by accident in public, and no efforts were made to save him until too late. Children have often been found suspended in such ways as have pointed to the accidental nature of the result; but instances are not infrequent of children committing suicide by hanging themselves. Those in charge should know, therefore, the proper course to be pursued in such cases. Death may be produced by Asphyxia, either by strangulation or by suffocation. In strangulation the pressure of the cord upon the windpipe closes the air passages. But death may arise from Apoplexy, the pressure of the cord stopping circulation through the vessels, but not completely closing the windpipe; or it may be caused by fracture of vertebræ, and rupture of, or damage to, the spinal cord. The latter condition occurs when the body falls from a height, as happens when a person undergoes the last penalty of the law. In the latter case death is immediate; in the former it may be some time before that result arrives. It is not necessary, in order to ensure death by hanging, that the feet should be off the ground. The pressure upon the vessels may be sufficient to give rise to apoplexy or death by asphyxia even when the toes touch the ground. In other cases a person may faint in consequence of fright, or from other causes, and a tight ligature round the neck may accidentally become tighter and cause death by strangulation. Death may arise, therefore, from three different causes, of which a ligature round the neck may be the prime factor. In all cases of hanging the first thing to be done is to cut down the victim. It is curious, but this is not always done by the bystanders. People often run for assistance instead of at once cutting the cord, or raising up the body so as to loosen it between the neck and the object to which the cord is attached. It has happened on more than one occasion, that companions have run away for help, and left their friend to his fate, when a moment's thought, such as placing one's head and shoulders between the hanging person's legs and raising him up, so as to take the pressure off the cord, would have saved the sufferer from his untimely fate. If there are two persons at hand, one should do this whilst the other procures a knife or some other sharp instrument, if he has not one in his pocket, and cuts the cord as quickly as possible. Then all tight clothing about the neck and chest should be at once removed. If (as is probable) the head and face are frightfully congested, cold water may be dashed upon them, whilst the hands and feet are kept warm and dry. If a smelling-bottle or salts of ammonia are at hand, they may be applied to the nostril. But the most important thing to be done is to use artificial respiration in the same manner as is recommended in cases of drowning. It might be beneficial in certain cases in which apoplexy is imminent, for some blood to be taken from the arm, or even from the jugular vein; but this can only be done by a skilful surgeon. The indications are to set up respiration and to relieve the overloaded vessels, whilst cold effusion may be beneficial in emptying the gorged vessels in the head. The body must be kept warm. If blood is taken, it must be by a free blood-letting, for it is more for the purpose of relieving the pulmonary circulation than the threatening apoplexy. As in drowning so in hanging, there may be syncope or fainting, which may have preceded the act of strangulation. It is necessary, therefore, to continue artificial respiration as long as the least doubt remains as to the result. The heart may continue beating in a very indistinct and inaudible manner long after the pulse has ceased to be felt or the breath to be perceptible to ordinary observers. Be careful to free the mouth and throat from any possible foreign bodies. Death sometimes results from direct strangulation, by the forcible compression of the neck by thieves on the highway and which goes by the name of garotting. In these cases insensibility results from asphyxia or syncope; asphyxia results from the impediment to proper aeration of the blood, whilst syncope is the result of either fright or shock to the cardiac nerves. It is sometimes said that some anæsthetic, such as chloroform, had been used to aid the operation of the thief. But this is imaginary.

There is no anæsthetic in common use which can be of any service in the short time at the command of the thief; and when victims have detailed such an event it has been imaginary and not real. No reliance is to be placed upon the statement of those who assert that they were chloroformed before they were robbed.

SUFFOCATION BY CHOKING.

Accidents of various kinds may produce this result. I have known of more than one instance in which a lump of meat has gone into the trachea (or wind-pipe), instead of the pharynx (or gullet), and death has resulted. In every case of supposed apoplexy, or of any kind of fit, it is right to examine the throat, especially if the individual was eating at the time of the supposed fit. Suffocation results whenever air is prevented from entering the air passages. Children are often suffocated in bed by the clothes being drawn too tightly over their mouths either by accident or design. Coins have been put into the mouth for various purposes, and have accidently passed into the larynx and have produced suffocation. Pepper has led to choking by being drawn into the wind-pipe. When suffocation results from the presence of a foreign body, such as a lump of meat, or coins, or such like, introduce the finger into the throat as quickly as possible, and displace the offending body. A tallow candle may be used with effect to push it down if it is something which sticks in the gullet and compresses the wind-pipe. If the foreign body has entered the trachea there is nothing to be done unless a surgeon is at hand to open the wind-pipe and allow of respiration by that means. When suffocation is supposed to have resulted from smothering, artificial respiration and removal into fresh air are the proper means to be adopted in all cases. It is especially necessary to be sure that no foreign body is present in the throat, as a very small matter at the top of the wind-pipe may excite spasm and close the passage. If a candle is not at hand, a feather may be used, or any soft body which may act by displacing the offender. When a fish bone is the cause, it may be picked out by a pair of tweezers, or pushed down by the handle of a spoon. If a coin has entered the trachea, it might be beneficial to place the patient with the heels upwards, so as to allow the foreign body to drop back again by its own weight.

Action of Poisonous Gases.—The fumes of burning charcoal, the fumes from faulty stoves, the escape of coal gas into bedrooms, and of gases which are produced for the purpose of chemical experiment, sometimes give rise to serious accidents, and may cause death by suffocation. The indications for treatment in such cases are to get the patient into the fresh air, to promote respiration by artificial action, to relieve the venous congestion, supply fresh air, and to combat the tendency to death, according as it appears to be from asphyxia, or apoplexy, or syncope; bearing in mind that the danger in asphyxia is the absence of air in the lungs, and that there must be a free current of air around the patient, whilst artificial respiration is performed as regularly as possible; that the crowding of a number of people around the insensible person is increasing the danger; that pure air is a necessity. In asphyxia there is suspension of animation, with flushed or livid face, staring and congested eyes, and veins full to bursting, but pulse scarcely perceptible. In apoplectic tendencies there may be similar condition with stertorous breathing, that is, a noisy kind of breathing and flapping of cheeks, with a full pulse; artificial respiration will not be useful. In syncope there is palor rather than lividity, and death-like coldness, the limbs are flaccid, and the pulse, though extremely feeble and thread-like, may be felt occasionally. Artificial respiration is not so necessary as warmth and quietness, whilst the gentle application of ammonia to the nostrils, a little hot tea or sal-volatile and water by tea spoonfuls into the mouth, and the recumbent position, with an instant removal of all tight clothing, are the best means to be adopted to restore the suspended animation.

CEREBRAL OR BRAIN DISTURBANCE.

This class includes a number of cases which are pathologically and medically incongruous; but to the non-professional eye are very similar: they may be caused by accident or arise from disease.

They are *Concussion of the Brain*, from shock, either mental or physical. *Compresssion of the Brain*, from fracture of the skull-bones, or effusion within the cranical cavity. *Coma*, or unconsciousness which follows *Epilepsy*, or a certain kind of *Convulsion*, and the insensibility of *Intoxication*, on the sequence of *apoplexy*. Suspended animation of *syncope*. Some *hysterical conditions*, which may simulate either of the above, and *Catalepsy*, or *Trance*.

I propose to note the signs which distinguish the one from the other, and also the treatment to be pursued in each kind.

Concussion and Compression.—A person has a blow upon the head, as by falling down stairs, or from the branch of a tree; he may have fractured his skull, and some of the bony covering may have been drawn into the brain substance, or he may be suffering only from the effects of concussion. The blow may have temporarily suspended circulation through the brain, and the development of nerve force is stayed without having produced any physical damage to nerve substance. The symptoms of both Concussion and Compression are similar in the first stage. There is total insensibility; the pulse is feeble, perhaps intermittent, and the extremities cold. If death is not immediate, there is, after a short time, a slight warmth over the body; the pulse becomes more perceptible, and the breathing is sighing and irregular. Sometimes a vomit takes place, especially if there is fresh food in the stomach; the patient may talk for a short time in an incoherent manner, then open his eyes, which were closed, looks round with an astonished expression, and becomes himself again. This stage may occupy a few minutes, or it may last for some hours, and the patient come out of it very gradually. Slighter cases of Concussion simply stun the patient for a short time only. Vomiting is not a serious sign in severe cases; it is sometimes more significant in those apparently slighter cases, in which the patient expresses himself as all right again, and determines that there is nothing the matter with him. Great care is necessary in such cases to avoid excitement, to avoid heavy meals, and to get quiet sleep. Inflammation of the Brain may arise from the effects of the concussion, or there may be fracture of the skull from *contre-coup* without displacement. When such is the case there is headache, occasional vomiting, then feverishness, a stupid-looking state supervenes, and coma, or insensibility, comes on either gradually or suddenly after a convulsion. The symptoms which indicate compression may be manifest from the first, in consequence of the state of the

skull-bones, or from considerable bleeding from the ear, which is indicative of a fractured base of skull. In simple concussion there is no stertorous breathing, and the pupils are not irregular, and they act when light is thrown suddenly upon them; whilst in compression one or both pupils may be widely dilated, and are not sensible to the influence of light. When a person is first found, whether suffering from concussion or compression, he must not be raised up, but kept in the recumbent position, with the head raised not more than three inches from the ground on a wedge-shaped pillow, which may be made by a few articles of clothing or a folded blanket. In carrying such a case to the nearest house or place of refuge, great care must be used to avoid any increase to the damage by injudicious movement. If a stretcher can be procured from the nearest police station, so much the better; but failing that, it is easy to make one by means of a couple of poles, with a stout blanket, or a horse-cloth, or any material which can be attached to the poles, and tied by string, or rolled round them and stitched together, so that the latter are about two feet apart, and the patient then placed lengthways upon the cloth and carried by four persons, as bearers, not raising the patient on to the shoulders as is usually done, but keeping the poles at some eighteen inches from the ground and the bearers stepping together so as not to jar the patient. They should carry him head foremost and arrange for the taller persons of the party to take the foremost places. It is sometimes difficult to keep the poles from falling together; this may be obviated by two cross-bars between them about two feet long, which may be obtained from a forked branch of a tree, if a saw is not at hand to manufacture one from a piece of board. It is highly mischievous to place an injured person in a cab or cart for conveyance to the hospital, or to the house unless a proper arrangement has been provided, such as is in use in the ambulance waggons attached to the military service. The stretcher is by far the best means of conveyance in all cases of accident or unconsciousness. The fresh air which is obtained by movement will often be of service, whilst if care is used by the bearers to step all together, and the patient kept in the recumbent position as advised, no increased mischief will result to the case, whether it be from unconsciousness or fracture of any bone. Long-continued quiet, simple diet, and freedom from all exciting conditions, are especially necessary in all cases in which the head has been injured.

Every large school should have instruction in this method of carrying injured persons. The medical attendant should be asked to advise the boys upon it; an occasional ambulance drill, in which a boy should be carried on an improvised stretcher and the bearers taught to step together and carry their companion without jerk and by a steady movement, would save much suffering to the actually injured, and would be of more service in after life than much of the knowledge which is ordinarily taught in schools.

The *Coma*, or unconsciousness from *Apoplexy*, *Epilepsy*, or opium *Drunkenness*, are difficult to recognise or rather to diagnose the one from the other. If the two last are suspected in consequence of the smell of the breath, it is right to use the stomach pump, so as to withdraw the narcotic which may still be in the stomach, and prevent further absorption, and a medical man should be sent for to do this as quickly as possible. The skin is generally warm and dry and the pulse quick if the drunkenness is recent. The person can be roused somewhat, but in the coma which has been caused by apoplexy, or that which follows epilepsy, there is perfect unconsciousness, the pulse is irregular and slow, sometimes full instead of small. There may be flapping of the cheeks, dilated or irregular pupils of the eyes. If it is the sequence of an epileptic fit, there is a leaden aspect of skin, which is cold, perhaps clammy, and some bloody froth may be about the lips, showing that the tongue has been bitten. The coma from epilepsy is sure to pass away if the fits do not recur; it is quite unnecessary to give anything in any of these cases except a little cold water. The mischief which may be set up from forcing stimulant down the throat of a semi-conscious man or child is sometimes very great. Leave the patient in the recumbent posture, unfasten everything which is tight around the throat or the waist, keep the feet warm, and wait until the doctor arrives and indicates the proper thing to be done. More mischief is done by meddlesome assistants in these cases than can possibly arise from doing nothing. In opium poisoning the pupils are contracted, the pulse feeble, the respiration slow, and the skin cold; but the patient may be roused, and must not be allowed to sleep. He should be made to walk about until the stupor passes away.

A hysterical faint and cataleptic unconsciousness will be recognised by the quivering eyelids and lips, and the absence of those signs which indicate danger in the cases previously mentioned. They are better let alone, giving fresh air and effusing the face with cold water, and loosening all ligatures in clothing, but not wetting the dress. Cataleptic cases are not uncommon among schoolboys and girls; there is complete rigidity of the extensor muscles, the jaws are fixed and the eyelids closed and the skin cold (in hysterics it is warmer). When such cases occur in schools they should be transferred to the care of their friends, otherwise unconscious imitators may be found, and the disease become intractable. There is no immediate danger to the child, and it is not often that the fit comes on when no one is present to observe it.

(To be continued.)

Eminent Practical Teachers.

DAVID STOW,

Founder of the Training System of Education.

BY JOHN R. LANGLER, B.A., F.R.G.S.,

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V.

THE 'simultaneous method' of answering was, as we have said, a distinguishing feature of the Glasgow System. For its most effective employment it assumed that 'the gallery' consisted of children of nearly the same stage of intellectual development. But though in many cases this ideal arrangement was not possible, the great majority in all schools could be always benefited by a gallery lesson on some ordinary topic. Even when, on account of deficiency of staff, subdivision was impossible, a small margin of 'little ones' did not very seriously interfere with the effect which the fresh thought, the vital energy, of a competent trainer unfailingly produced. Such a teacher never considered the *mere* mechanical 'answering together' of the mass of children, as the simultaneous method under

the Training System. If the replies thus given were not usually the result of thought; if the 'questions and ellipses mixed' did not ultimately lead the children to 'draw the inference,' to 'give the lesson,' themselves; if, in fine, under the guidance of the trainer, the 'gallery' did not come to a logical conclusion or 'make the application' of their own accord, the process was considered to be a failure. 'You must not expect all the children to answer at the same time' in the first instance, as 'each child will sympathize with that class of questions suited to his own natural cast of mind' (Hint 11), but the correct answers of the few were, by the skill of the trainer, to be made the property of all; and the question or ellipsis having been repeated in another form, a true 'simultaneous answer' was possible. These remarks are intended to refute the frequent assertion, that the simultaneous method is wholly mechanical. Under the Training System this was simply impossible. But we must defer a detailed exposition of the method to a future occasion, and content ourselves at present with this brief indication of its educational value. For its misapplication or its abuse Mr. Stow cannot be held responsible. He did not advocate that all the instruction in school should be derived from the 'trainer,' that no text-books should be used, and that the individual pupil should never attempt an independent effort. The acknowledged effect of the oral lesson in awakening the intelligence, and the apparent economy of the simultaneous method in regard to school staff, may, however, have led to strong prejudices in favour of the constant use of the gallery, for he ever maintained that 'the exercise of the faculties is the chief and important part of education, not the mere amount of knowledge imparted,' and he insisted that this exercise of the faculties was best stimulated by mental contact with the teacher. But though he thus urged the importance of teaching, he did not discourage *learning* as an effort on the part of the pupil.

Before entirely quitting this topic notice should be taken of the application of the simultaneous method to the art of reading aloud. 'Elocution is simply audible reading conducted in a clear, distinct, and proper manner,' and Mr. Stow contended that 'from the very earliest stage' the child should be trained to 'be an elocutionist.' Without entering into details as to the gallery drill, the uniform and advantageous mode of holding books, etc., it may suffice to say that large classes of children were trained on this method to 'articulate every syllable distinctly, and to read each word separately,' and with such variety of tone and inflection as to indicate an appreciation of the meaning. Perfect reading implies, of course, high intelligence, but this intelligence may exist without the power of vocal expression, which can only result from extensive practice. Reading together was thus undoubtedly economical as affording the requisite practice, and the imitation of the model rendering of an author by the teacher tended to secure an interest in literature which is but too rarely found in a certain class of children after they have left school. Individual and simultaneous exercises were mixed in the progress of each lesson, and there was thus a constant stimulus to attention and to excellence. The trainer was instructed to pause between the syllables; to 'rest firmly on the consonants;' to separate the words, and thus to read slowly, articulately, and emphatically. Phrase-reading, sentence-reading, and paragraph-reading, were the more advanced stages of a process of which pattern-reading was a prominent part.

All that pertains to the physical welfare of children at school was included in the Glasgow System. Mr. Stow was, in respect of sanitary matters, in advance of his contemporaries. The lofty halls erected for his schoolrooms, with ample provision for light and ventilation, formed a striking contrast to those of some school-houses, as well as to the homes of many of the children in the lower parts of the city. Spacious playgrounds, with 'swing-poles' and other gymnastic apparatus, were provided. In the schoolrooms, and between the lessons, there was marching to songs, in which all joined, and, with infants especially, 'physical exercises' were resorted to during a lesson, in order to give necessary relief to the body and recall the 'wandering eye.' 'A stronger sympathy exists between the intellectual, the moral, and the physical powers than is generally imagined. The great secret of securing the attention of children, and thereby training their mental and moral powers, lies in a proper and continued variety of physical or bodily exercise' (Hint 39). No lesson was begun, therefore, without 'drilling the troops in the gallery' and obtaining 'perfect silence,' with 'every eye fixed on the teacher.' The *infant* 'troops' always need most 'drilling,' and the little ones thus gain habits of order and prompt obedience—that is, of exact discipline. A clap of the hands or a purposely-excited laugh, 'lets off the steam' and 'prevents explosions' otherwise unavoidable. These are now accepted and common practices, at least, in infant schools, but they were systematically developed as a part of the Training System. Mr. Stow pointed out that these physical exercises might be used as an end; or, in regard to the intellectual training, as a means to an end, viz., to secure attention.

Cleanliness and neatness in the person, in the furniture, and in all the surroundings were always insisted upon; and the care of certain articles in the schoolroom or in the play-ground was a favour allowed to certain children in turn. 'Dirt and disorder' were unfamiliar. The Training School of necessity promoted the physical welfare of the children.

'All the improvements in education that of late years have appeared in England worth mentioning can be easily traced to the Glasgow Normal Seminary.' This was the declaration of the Marquis of Lansdowne, the Lord President of the Privy Council in 1848. Its absolute accuracy may perhaps be open to question; but, doubtless, the marvellous 'results' exhibited in the 'four departments' at Dundas Vale had led to inquiry on the part of earnest educationists, and to their subsequent adoption of some or of all the methods there employed. Attention was attracted to the Glasgow System not so much by the brilliancy of its intellectual developments as by the apparent efficacy of its moral power. The leaders of the several religious denominations thought they saw in the Moral Training System the ready means of accomplishing the main purpose of education, and procured from the Normal Seminary 'trainers' to carry out Mr. Stow's principles and methods in various parts of the world. Allusion has been made to the numbers of teachers sent by the Wesleyan body to Glasgow; but the Training Colleges at Cheltenham, Whitelands, Homerton, as well as Westminster, 'adopted and advocated the same prin-

ciples.' The marked differences of method which were formerly so prevalent have under the system of Government inspection largely disappeared; but even in the existing uniformity there remain, nevertheless, some of the distinctive characteristics of the Training System.

(To be continued.)

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Anecdotal Natural History.

BY REV. J. G. WOOD, M.A., F.L.S.,

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AND THEODORE WOOD,

Joint Author of 'The Field Naturalist's Handbook.

No. XXIII.—THE MARSUPIALS.

PART II.

WE now come to the second sub-family of the *Macropidæ*, or Marsupials, namely, the *Macropina*, which comprises the various Kangaroos. These are by far the most familiar of all the animals of the group, and present several important peculiarities of structure by which they may be readily recognised.

The most striking of these distinguishing characteristics we find in the structure of the hinder feet, which are always longer than those of the fore limbs, and are wonderfully adapted for purposes of leaping, in which exercise the kangaroos are singularly proficient. There are also various minor details of structure, such as the character of the dentition, etc., with which, however, we need not trouble ourselves.

THE first animal upon our list is the remarkable Tree Kangaroo (*Dendrologus ursinus*) of New Guinea, which, as its popular title implies, spends a considerable portion of its existence amongst the branches of trees. In this animal the hinder feet are not of such surprising length as is the case with the members of the typical genus, and are formed far more for ascending and descending the trunks of the trees in which it makes its home than for running or leaping upon level ground.

The fur, which is of a remarkably stiff and bristly nature, is of a deep jetty black upon the upper parts of the body, the under surface being of a yellowish or reddish-brown. The tail is wonderfully long, and appears to be of considerable service in assisting the animal to retain its balance while engaged in its arboreal evolutions. There is one very singular feature about this tail, namely, that it cannot be either twisted or curled. Consequently, when the animal is resting upon a branch, the tail hangs almost perpendicularly beneath it, thereby presenting a very strange and grotesque appearance.

The ease and rapidity with which so apparently a clumsy an animal can ascend and descend the trunks and traverse the branches of trees are simply astonishing, the creature seeming to move with almost the certainty and ease of the squirrel. Unfortunately, what little we know of its habits has been gathered chiefly from observations made upon captive animals, and we cannot, therefore, describe with any certainty its mode of life in a state of freedom. Its food appears to consist chiefly of young shoots, bark, berries, and leaves, procured from the trees in which it takes up its abode.

There was a very fine Tree Kangaroo in the Zoological Gardens about 1865 or 1866. A tree trunk with large branches was placed diagonally in its cage, and every spectator was struck with the curious sight which it presented as it leaped up and down from the branches to the trunk and back again, seldom coming on the floor of the cage.

WE now come to the true Kangaroo (*Macropus major*), which far exceeds in size the preceding species. Indeed, an adult male kangaroo is a really large animal, measuring fully seven feet six inches from the nose to the tip of the tail, of which the body occupies considerably more than half. The tail, too, is unusually large, generally measuring eleven or twelve inches in circumference at the base.

This tail is used for a somewhat curious purpose, serving, together with the hinder limbs, to support the animal when sitting upright.

The dentition of the kangaroo is somewhat remarkable, the lower front teeth projecting forwards. They are lancet-shaped, nearly flat, double edged, and each edge is serrated, like the teeth of the shark. An experienced kangaroo hunter told me that these teeth are used like sickles for cutting grass, the kangaroo holding the grass together with its forepaws, and then sawing the stems asunder with its sharp-edged teeth.

The female kangaroo is very much smaller than her mate, the difference in size, in fact, being so remarkable, that the two animals might well be supposed to belong to two distinct species. Six feet, indeed, appears to be a limit seldom or never exceeded by the female, while in weight, also, she is far inferior to her lord, who averages from one hundred and fifty to one hundred and sixty pounds. In both sexes the fur is of a brown hue mingled with grey, the lower part of the body being of a rather lighter tint. The forepaws and the tip of the tail are black.

The kangaroo can scarcely be termed a gregarious animal, and yet assembles in small flocks, each of which is composed of seven or eight members. Even these bands, small as they are, do not appear to be closely united, the animals which compose them generally feeding at some little distance from one another, and seeming to act upon no preconcerted plan in cases of danger, as is the case with animals in general.

Owing to the value of its flesh and skin, the kangaroo is in great demand both with natives and colonists, who persecute and destroy it in every possible manner. With the former, pit-falls and snares are frequently brought into requisition, while the latter generally make use of the more legitimate methods of pursuit. Indeed, in many districts, a kangaroo hunt is one of the staple forms of amusement, dogs being specially kept and trained for the chase, just as are foxhounds in England. Nor is the sport altogether without its dangers, for an adult male kangaroo, or 'boomer,' as it is generally termed, is by no means a despicable antagonistic for the most powerful and active dogs; or, indeed, for a human being not provided with fire-arms.

The mode of fighting adopted by the kangaroo when fairly brought to bay is rather peculiar. Placing its back against some tree, in order that it may not be attacked from behind, it awaits the onslaught

of the dogs, who are, generally, only too eager to rush upon their foe.

No sooner does one of them come within reach, however, than a sudden sharp stroke is delivered by one of the hinder feet, which, being armed with a long and sharp claw, are capable of inflicting very severe wounds. Indeed, instances are by no means unusual of a dog being completely ripped up by a single stroke from the terrible foot of the kangaroo. In this manner a kangaroo will often keep at bay a whole pack of dogs, their combined efforts being insufficient to drive the animal from its post of vantage.

These claws are so long, and strong, and pointed, that they are used as heads for spears. It seems hardly fair to use the kangaroo's claw for the purpose of killing the kangaroo, but the Australian is obliged to do so, just as the Esquimaux kill the walrus with a spear headed with walrus ivory.

Except as a last resource, however, the kangaroo seldom fights, preferring to trust to its fleetness rather than to the formidable weapons with which nature has provided it. When chased, it often evinces the most remarkable cunning in its attempts to throw its pursuers off the track—attempts which are not always unattended with success.

One of the most favourite of these stratagems consists in a sudden and violent leap at right angles to the track. The anima lthen lies quietly among the brushwood until the hounds have passed by its place of concealment, when it noiselessly makes off in another direction.

With such violence is this sidelong leap taken, that in more than one case the leg of the animal has been broken by the severe strain suddenly laid upon it.

One of these animals, which was brought to bay, actually seized with its fore-paws the dog which was leaping at its throat, sprang to a river that was within a short distance, and held the dog under water until it was drowned.

As a general rule, the 'boomer,' or male kangaroo, is alone useful for purposes of the chase, the female usually giving but little trouble to the hounds, and not unfrequently dying of sheer terror without receiving the slightest injury. When quite young, however, she will sometimes afford very fair sport, her wonderful speed earning for her the title of 'Flying Doe.'

The bounds by which the animal progresses are of really wonderful length, the more so when we consider the rapidity and seeming ease with which they are made. Mr. Gould tells us that the spring of a full-grown 'boomer' was found to measure exactly fifteen feet, and that the distances between the footprints were as regular as if they had been stepped off by a sergeant.

The power of making these extraordinary bounds is owing entirely to the structure of the hinder feet, which are exceedingly long in proportion to the remainder of the limb. Unless the animal be alarmed, however, it proceeds in a far more deliberate and somewhat clumsy manner, balancing itself upon its broad and powerful tail, and swinging the hinder limbs forward much after the fashion of crutches. It is often imagined that the large and powerful tail forms an important auxiliary to these hinder feet in making the lengthy bounds for which the animal is so famous. This, however, is not the case, that organ seeming to be only employed in supporting the animal when sitting erect, and in assisting it to retain its equilibrium while leaping through the air.

THE largest of the *Macropidæ* is the Woolly Kangaroo (*Macropus laniger*), so called from the peculiar texture of the fur, which bears a considerable resemblance to cotton-wool. In size, this animal considerably exceeds the last-described species, an adult male averaging as much as eight feet and two or three inches in total length.

From the common kangaroo it may be easily distinguished by the colour of the fur, which is of a reddish-yellow hue, changing to grey upon the head and shoulders. The toes are covered with short black hairs. A white patch is found at the sides of the mouth, and, in the female animal, extends as far as the eyes. This species is an inhabitant of Southern Australia.

NEXT upon our list of Marsupials comes the celebrated Rock Kangaroo (*Petrogale penicillata*), which is, among rocks and precipices, very much what our common native squirrel is among trees.

The rapidity with which the animal will make its way over seemingly impassable crags is said to be truly marvellous. Once amidst the rocky ground in which it delights to dwell, it can set at defiance its two chief enemies, namely, the dingo, or wild dog, and the native hunter, its wonderful speed and activity enabling it to traverse ground where pursuit is out of the question.

Even should the hungry native succeed in tracking it to its lair, he gains but little advantage thereby, for the rock in which its retreat is usually situated is generally of so hard a nature as completely to set at defiance the rude tools possessed by the savage hunter, while the various exits with which it is always provided allow the smoke to pass through without disturbing the inmate, should its would-be captor resort to the use of fire.

It is, indeed, very seldom the case that the rock kangaroo will allow itself to be captured without considerable difficulty, save and except upon the occasional instances when it basks in the sunbeams, and abandons itself entirely to the enjoyment of the genial warmth. Upon such occasions it is so completely absorbed in its luxurious occupation that it may be approached and slain with comparatively little difficulty.

Although selecting by preference rough and broken ground for its usual haunts, this kangaroo appears to be quite at its ease among trees, ascending and descending the trunks with considerable facility, provided that they be not perfectly perpendicular.

The rock kangaroo is a far smaller animal than either of its above-described relatives, a full-grown male only measuring a little more than four feet in total length. The tail is furnished at the extremity with a tuft of long bristly hairs, which has sometimes earned for the animal the title of 'Brush Kangaroo.' The fur, which is of a purplish grey hue, is of no great value, its texture being decidedly coarse, and unfitting it for use in the purposes for which the skins of its congeners are employed.

THE Brush-tailed Bettong, or Jerboa Kangaroo (*Bettongia penicillata*), is of very much smaller dimensions than any of the preceding animals, scarcely equalling, even when fully adult, an ordinary English hare in size. It is a pretty and graceful little creature, bearing a strong resemblance in general appearance to

the Kangaroos themselves, to which animals, indeed, it is very closely related. In many particulars, however, it differs from the Macropina already described, the head being short and broad, and the tail endowed with considerable prehensile power. The colour of the fur is a pale brown, pencilled with white, the lower portions of the body being of a somewhat lighter hue. The extremity of the tail, which is decorated with a tuft of longer hairs, is black.

This pretty little animal does not reside in crevices of rocks, etc., after the manner of the rock kangaroo, but constructs for itself a dwelling in a somewhat singular manner. Taking advantage of some natural hollow in the ground, it scoops out the soil until a convenient depth is attained. The next step is to cover this hollow with a roofing of grasses, etc., so arranged that it exactly coincides in height with the tops of the surrounding vegetation. This is so ingeniously managed by the animal that, except to the practised eye of the native hunter, which immediately detects the slightest inequality among the herbage, it is almost invisible, the work being so neatly performed that scarcely a sign betrays the presence of the cleverly constructed domicile.

The animal conveys the materials selected for her nest to the site of the intended dwelling in a somewhat curious manner. First procuring a considerable quantity of leaves, grasses, etc., she forms them into a kind of sheaf, round which she twists her tail, hopping off, thus laden with her burden, to the nest. As soon as the material thus collected is used, she sets off in search of a second supply, and so on until the requisite quantity has been obtained.

This animal is extremely common in New South Wales, but, owing to its nocturnal habits, is comparatively seldom seen, except by those who go in search of it. In spite of its small size it is wonderfully active, and will travel over the ground at a really wonderful speed should it be pursued or otherwise alarmed. When hard pressed it has, like the kangaroo itself, a curious habit of leaping off suddenly at right angles to its course, and concealing itself in some crevice, in the hope of escaping the observation of its pursuer.

IN the Kangaroo Rat (*Hypsiprymnus minor*), or Potoroo, as it is termed by the natives, we have one of the transitional links between the *Macropina* and the animals composing the next group of the marsupials, the general kangaroo form and appearance being preserved, while the power of leaping, and also of manipulating food and other objects with the fore-paws, is altogether wanting. It is true that the animal is able to sit upright, after the fashion of the kangaroos, supporting itself by a kind of tripod formed of the hinder limbs and the tail. Here, however, the resemblance ceases, the mode of progression employed by the potoroo consisting of a curious gallop, very different from the powerful bounds of the preceding animals.

The title of Kangaroo Rat is due to the nature of the tail, which is covered with scales, between which proceed a number of scattered hairs. It is not a very large animal, the total length being only some twenty-eight inches, of which rather more than one-third is occupied by the tail.

The Kangaroo Rat is tolerably plentiful throughout New South Wales, and, not being so exclusively nocturnal in its habits as is the Brush-tailed Bettong, is far more often seen. It feeds chiefly upon roots, which it extracts from the ground by means of its powerful claws, which form very efficient weapons for tearing up the soil.

Owing to the nature of its food, the potoroo is a terrible nuisance upon cultivated land, often causing severe loss to the agriculturist by its ceaseless ravages. The potato seems to be a particular favourite article of diet with the animal, which continues its depredations day after day in spite of the attempts which are made to check its destructive proceedings.

THE Kangaroo Hare (*Lagorchestes leporoides*) is not at all unlike the animal from which it derives its popular title—colour, form, and habits being so remarkably hare-like that the name of kangaroo hare is singularly appropriate. The fur is close, hard, and slightly curled.

When alarmed, the kangaroo hare can run with the most marvellous celerity, often baffling even the best hounds by its wonderful speed, and also by the facility with which it doubles when closely pursued. Although usually progressing by means of a rapid gallop, it is by no means destitute of leaping abilities, and, should occasion require, will often execute the most wonderful bounds.

The kangaroo hare appears seldom or never to be found in the neighbourhood of the sea-coast, but seems to be confined to the interior of the country, where it is tolerably abundant.

With the kangaroo hare we must conclude our account of the members forming the group of the kangaroos, and shall in our next paper proceed to describe some further examples of this curious tribe of animals, which form one of the most interesting of all the great families into which the mammalia are divided.

BEFORE doing so, however, we will cast a glance at the 'marsupium,' or pouch, from which these animals derive their scientific name.

Many zoologists doubt whether the name is a satisfactory one, because the pouch is nothing more than a fold of skin, and there are many undoubted marsupials in which the pouch is practically non-existent, a mere wrinkle marking its position. The peculiarities of the marsupial structure are more internal than external, and, moreover, belong more to the young than to the adult animal.

It is impossible to describe the structure fully without the use of many and elaborate diagrams; but I will mention one or two of the most remarkable details.

No matter how large or how small the marsupium may be, the marsupial bones are always present. Even in the duck-bill, or platypus, and echidna, the marsupial bones are present, though the animals are not in any respect marsupials, but belong to a totally different order. Moreover, the marsupial bones are found in both sexes, though, of course, the male possesses no pouch.

Now we come to a very remarkable structure in the immature marsupial.

When introduced into the pouch it is affixed to one of its mother's teats in such a way that instead of receiving the teat into its mouth, its head seems to be drawn over the teat. At this period of life the young

one has not sufficient muscular power to enable it to suck, and the milk is continually forced down its throat by the compression of certain muscles peculiar to these creatures.

Now, if the structure of the young marsupial—say a kangaroo—were like that of other mammals, the little creature would be choked by the flow of milk; so the entrances to the respiratory and nutritive organs are separated by the modification of certain portions of the throat into a valve, which permits the milk to flow continuously down the throat while the channel of respiration is kept open.

The structure of this portion of the immature marsupial is almost identical with that of the whale tribe.

(To be continued.)

'How I Teach Elementary Science.'

BY RICHARD BALCHIN,

Head Master of the Gloucester Road Board School, London.

FOURTH-SCHEDULE SUBJECTS: MECHANICS.

'PARALLELOGRAMS of forces and of velocities.' This somewhat ambitious title would lead many to consider that the subject treated of was rather outside the limits of elementary instruction. Nothing, however, ought to be so considered which is fairly within the mental capacity of our scholars. And that this subject can be grasped by ordinary fifth and sixth standard boys, I have had abundant proof. I may mention, as a fact, that on the occasion of my giving the first lesson upon it, I asked a boy to come out and draw a line to show the direction of the resultant of two forces whose directions I had indicated on the blackboard; and the lad drew a line which I found, on completing the parallelogram, to be exactly coincident with the diagonal; so clearly did he perceive the nature of the subject. The truth is, the general principles or laws which are observed in the workings of nature around us, can be made clear to boys, just in proportion to the clearness with which the teacher himself perceives those laws. I am attending a course of lectures by Professor Seeley, and I cannot but note the enormous difference between his demonstration of a truth and that of our ordinary certificated science teachers. When listening to some of the latter, how soon it becomes manifest that their knowledge of the subject reaches just as far as the last page of the sixpenny text-book, and no farther.

Instead of reproducing a lesson, I will, in this article, endeavour to make clear what is meant by parallelogram of forces. Force is that which produces motion. It is measured by the amount of momentum it communicates. Momentum is compounded of mass and velocity. Weight is a measure of mass. Velocity is measured by the space passed over in a certain time. Now all those truths must be entirely understood before pupils are able to grasp anything concerning parallelogram of forces. It must here be understood that we speak of mechanical force only, not of heat force, or electric force, or chemical force. Let us take a mass of matter weighing 4 lbs. Let the number 4 represent such mass. It moves at a velocity, say, of 3 ft. per second. Good. Now we will compound the mass and velocity. Multiply 3 by 4, answer 12. Then 12 is a number which represents the momentum of a certain moving body. But the momentum of a body is a measure of the force which has communicated that momentum. Therefore, the number 12 may stand to represent a force. Again, take another mass weighing 3 lbs. Let its velocity be 2 ft. per second. Then the number which will represent its momentum will be 6, which may represent the force that has communicated this momentum. Here, then, we have two momenta, represented relatively by the numbers 12 and 6; and we say the first momentum is double of the second. Also we have two forces represented relatively by the same numbers. I have entered into these preliminaries somewhat in detail, because I so frequently hear and read such phrases as the following:—'let a force of 4 lbs. act;' 'let the line AB represent the direction of a force of 12 lbs.,' and so on. Now are not such statements misleading? What is a force of 4 lbs.? Can there be such a thing as 4 lbs. of force? I cannot conceive of such. Of course, when we wish to represent the relativity of different forces, we may let numbers or lines stand for their magnitudes or intensities.

If two forces of equal magnitude act simultaneously from exactly opposite directions upon a given point, they entirely neutralize each other; or in more correct language they are entirely converted into a resultant of heat force; with which at present we have nothing to do.

If two forces, from different but not exactly opposite directions, act simultaneously upon a certain point, the resultant, both as to direction and intensity, may be represented by the diagonal of a parallelogram whose sides represent respectively the two forces. This is a statement of the parallelogram of forces. I need not, however, proceed further with the subject, as all the ordinary text-books fully explain it.

This article concludes the series on the methods I have adopted for teaching the Fourth Schedule Subject, 'Mechanics.' I trust that those of my readers who have not yet taken up the subject as a 'special' will be induced to do so. Not that they will necessarily follow the lines I have laid down, for it is a subject that admits of an endless variety of treatment. In those articles I have confined myself more to the principles involved and of the methods of demonstrating those principles, rather than to their application to any of the practical businesses of life. But if I taught in a manufacturing centre, I should certainly arrange a syllabus for mechanics that would bear intimately upon the special industry of the locality. Suppose, for instance, my school were in Bermondsey. The syllabus should be framed so as to include the structure of skin, the nature of the various skin-coats of the pachydermata; something respecting the natural history of those animals whose hides yield leather; the chemistry of tanning, including the nature of tannic acid, and its action upon the gelatino-fibrous substance of the true skin; the sources of 'tannin,' whether as barks and other raw parts of trees, or as extracts such as 'gambir,' 'japonica,' etc. All these subjects might be taken in addition to the elementary principles of natural philosophy given in the code. And I am quite convinced, no inspector would object to such a syllabus, although it would not be at all points strictly coincident with the official syllabus. If

my school were at Burton-on-Trent, then I would arrange the work to include the scientific principles involved in brewing; and not a boy should leave my sixth standard without having the fact demonstrated beyond all manner of question, that the main business of the brewer was to utterly spoil vast quantities of valuable barley. To such an extent may we impart what is generally understood as technical knowledge. Still, however, we must not lose sight of the fact that science-teaching in our schools should always be educative rather than technical. That our chief work is not so much to turn out good tanners and brewers as to develop that general intelligence which will surely prove to be the primary element of success in whatever position of life our scholars may hereafter find themselves.

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Recent Inspection Questions.

[*The Editor respectfully solicits contributions—all of which will be regarded as* STRICTLY PRIVATE—*to this column. For obvious reasons, it cannot be stated in which district the questions have been set.*]

Arithmetic.

STANDARD I.

One sum each (A and B) dictated, the rest taken from the blackboard.

A.	B.
3401	5214
511	612
8	3
4060	4820
7980 Ans.	10649 Ans.
4016	8321
2109	4119
1907 Ans.	4202 Ans.
8164	7421
298	390
7866 Ans.	7031 Ans.

Spelling.

Table, chair, eye, house, butter.
Where is the man with his stick?
Jacket, shoe, mouth, head, cheese.
There are two great black dogs with their master.

STANDARD II.

A. A girl had 201 pins in a box. She gave 57 to her mother, 72 to her brother. How many had she left? Ans. 72.

9)17001	38,714	14,601
Ans. 1889	680	2,978
	26,325,520 Ans.	11,623 Ans.

B. I gave a girl 54 apples, a boy 73, and had 28 left. How many had I at first? Ans. 155.

9)16929	54,316	59,742
Ans. 1881	94	14,894
	5,105,704 Ans.	44,848 Ans.

STANDARD III.

(1) Find the difference between £29 0s. 6¼d. and £20,010 18s. 7¾d. Ans. £19,981 18s. 1½d.

(2) Divide 960,001 by 469. Ans. 2046—427.

(3) When a girl left school she had given her a prize of £5. She bought a pair of boots for 10s., paid 8s. 11d. for calico, 9s. 6d. for dress material, and 6s. for dressmaking. What had she left?
Ans. £3 5s. 7d.

(4) Add together (given partly in *words*) £29 0s. 5d., £10,011 18s. 6¾d., £1985 17s. 9½d., £2009 16s. 11¼d., and £853 19s. 6¾d.
Ans. £14,890 13s. 3¼d.

STANDARD IV.

(1) Reduce a million oz. to tons.
Ans. 27 ton 18 cwt. 0 qr. 4 lb.

(2) Reduce 1 ton 2 cwt. to lbs. Ans. 2464 lb.

(3) A man earned 24 shillings weekly. He spent 19s. 7½d. a week. How long would he be saving £6 10s. 4d.? Ans. 29 weeks, and 3s. 5½d. left.

(4) £18 19s. 7½d. × 621. Ans. £11,787 7s. 1½d.

STANDARD V.

(1) Find by practice the value of 9017 suits at £3 16s. 4d. each. Ans. £34,414 17s. 8d.

(2) A grocer bought 5 cwt. 2 qrs. of tea for £71 17s. 4d., of which 7 lbs. were spoiled. What would he gain or lose by selling the rest at 2s. 7½d. a lb.?
Ans. £8 1s. 3½d. gain.

(3) A bill:—13½ lb. of cheese at 8d. a lb., 3 boxes of figs (2½ lb. each) at 7d. a lb., 4 doz. oranges at 1½d. each, 9 boxes of tapers at 2s. 3d. per dozen boxes, ¾ lb. of tea at 4s. 4d. a lb., and 17 lb. of bacon at 10½d. a lb. Ans. £1 19s. 2¼d.

(4) A man who works 10 hours a day does a piece of work in 4½ days; how many hours would he have worked each day if he had taken 8 days? Ans. $5\frac{5}{9}$.

STANDARD VI.

(1) Find the value of $\frac{1}{3}+2\frac{1}{2}+4\frac{3}{4}+1\frac{5}{16}+\frac{3}{7}$ of $3\frac{1}{2}$ of $\frac{1}{6}$.
Ans. $8\frac{3}{4\frac{1}{6}}$.

(2) After spending $\frac{7}{16}$ of my money, I have 7s. 0½d. left. How much had I at first? Ans. 9s. 9d.

(3) Add together ·75 of 20s., ·75 of a guinea, ¾ of a crown, and ·125 of 24s. Ans. £1 17s. 6d.

(4) Find by practice the value of 36 cwt. 2 qr. 14 lb. of spice, at £7 11s. 6d. per cwt.
Ans. £277 8s. 8¼d.

(5) If a man can walk a certain distance in 1 hr. 18 min. 45 sec. by taking 76 steps a minute, how many steps a minute must he take to walk the same distance in 1 hr. 3 min.? Ans. 95.

(6) Find the value of $1\frac{3}{11}-\frac{4}{7}$, and of $1\frac{3}{11}\div\frac{4}{7}$, and reduce each answer to a decimal.
Ans. ·70129+; 2·22727.

Grammar.

STANDARD III.

Select nouns, verbs, adjectives, adverbs, and pronouns, in the piece given for dictation.

STANDARD IV.

(Parse the whole sentence).

(A) In our school stood a very old-fashioned clock with a brass face.

(B) We never came to school without taking a slight glance at our pets.

(C) We saw the old man with his youngest son by his side.

STANDARD V.

(Analyse and parse the words in italics.)

(A) *There* in the *shadow* of *old* Time
The halls *beneath* thee *lie*,
Which poured forth to the fields of yore
Our England's chivalry.

(B) *How bravely and* how solemnly
They stand 'midst oak and yew,
Whence Crecy's yeomen *haply formed*
The *bow in* the battle true.

Composition

STANDARD VI.

(A) What occupation would you choose to follow after you leave school? Give reasons for your choice.

(B) Write an account of two ways in which you would spend a holiday.

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ANSWERS TO

Pupil Teachers' Examination Papers.

Nov. 25th, 1882.

CANDIDATES.

Three hours and a half allowed for this paper.

Arithmetic.

MALES.

1. Find by practice the value of 6 tons 11 cwt. 1 qr. 24 lbs. at £1 18s. 6d. per cwt.

		£	s.	d.
Value of 1 cwt.	=	1	18	6
				131
,, 131 ,,	=	252	3	6
,, 1 qr. = ¼ value of 1 cwt.	=	0	9	7½
,, 16 lb. = ¼ ,, ,,	=	0	5	6
,, 8 ,, = ½ ,, 16 lb.	=	0	2	9
		£253	1	4½ Ans.

2. If the rates on a house, of which the rent is £63, be £9 16s. 3d., what is the rent of a house on which the rates amount to £11 8s. 11½d.?

£9 16s. 3d. : £11 8s. 11½d. :: £63 : ?
or or
4710 halfd. 5495 halfd.

$$\frac{£63 \times 5495}{4710} = \frac{£346185}{4710} = £73\ 10s.\ \text{Ans.}$$

3. If 24 men can build a wall in 40 days, and 6 men leave after 4 days, in how many days will the remaining men finish the wall?

18 men : 24 men :: 36 days : time required.

$$\frac{36 \text{ days} \times 24}{18} = 48 \text{ days. Ans.}$$

4. If 8 cwt. 14 lbs. be carried 30 miles for 10s. 6d., how far should 19 cwt. 2 qrs. be carried for the same money?

19½ cwt. : 8½ cwt. :: 30 miles : ?

$$\frac{30 \text{ miles} \times 65 \times 2}{8 \times 39} = 12\tfrac{1}{2} \text{ miles. Ans.}$$

5. If 12 men and 6 boys do a piece of work in 22 days of 8 hours each, in how many days of 9 hours each would 16 men and 4 boys do the same, 2 men doing as much as 5 boys?

12 men = 30 boys.
16 ,, = 40 ,,
44 boys : 36 boys
9 hs. : 8 hs. } :: 22 days : ?

$$\frac{22 \text{ days} \times 36 \times 8}{44 \times 9} = 16 \text{ days. Ans.}$$

FEMALES.

1. Make out the following bill:—81 lbs. tea, at 2s. 11d. per lb.; 99 lbs. coffee, at 1s. 7½d. per lb.; 54 lbs. cocoa, at 1s. 5d. per lb.; 243 lbs. rice, at 2¾d. per lb.; 31 lbs. 8 oz. butter, at 1s. 10d. per lb.; 63 lbs. loaf sugar, at 7½d. per lb.; 108 lbs. moist sugar, at 3½d. per lb.; 38 lbs. 4 oz. bacon, at 10d. per lb.; 55 lbs. 2 oz. cheese, at 8d per lb.

		s.	d.		£	s.	d.
81 lbs. tea	at	2	11	per lb. ...	11	16	3
99 ,, coffee	,,	1	7½	,, ...	8	0	10½
54 ,, cocoa	,,	1	5	,, ...	3	16	6
243 ,, rice	,,	0	2¾	,, ...	2	15	8¼
31½ ,, butter	,,	1	10	,, ...	2	17	9
63 ,, loaf sugar	,,	0	7½	,, ...	1	19	4½
108 ,, moist do.	,,	0	3½	,, ...	1	11	6
38¼ ,, bacon	,,	0	10	,, ...	1	11	10½
55½ ,, cheese	,,	0	8	,, ...	1	16	9
					£36	6	6¾ Ans.

2. Find the cost of 14,773 ac. 2 roods of land at the rate of £63 10s. 6d. per acre.

		£	s.	d.
Cost of 14,773½ ac. at £1	=	14,773	10	0
				63
,, ,, £63	=	930,730	10	0
,, ,, 10s. = ½ at £1	=	7,386	15	0
,, ,, 6d. = 1/20 at 10s.	=	369	6	9
		£938,486	11	9 Ans.

3. What is the value of one thousand four hundred and ninety-one articles at £32 11s. 1d. each.

		£	s.	d.
Value of 1,491 arts. at £1 each	=	1,491	0	0
				4
		5,964	0	0
				8
,, ,, £32 ,,	=	47,712	0	0
,, ,, 10s. ,, = 1/20 v. at £1	=	745	10	0
,, ,, 1s. ,, = 1/10 ,, 10s.	=	74	11	0
,, ,, 1d. ,, = 1/12 ,, 1s.	=	6	4	3
		£48,538	5	3 Ans.

4. Find the cost of 30 cwt. 3 qrs. 9 lbs. 12 oz. at £16 6s. 8d. per cwt.

		£	s.	d.
Cost of 1 cwt.	=	16	6	8
				30
,, 30 ,,	=	490	0	0
,, 2 qrs. = ½ cost of 1 cwt.	=	8	3	4
,, 1 ,, = ¼ ,, 2 qrs.	=	4	1	8
,, 8 lbs. = ½ ,, ,,	=	1	3	4
,, 1 lb. = ⅛ ,, 8 lbs.	=	0	2	11
,, 8 oz. = ½ ,, 1 lb.	=	0	1	5½
,, 4 oz. = ½ ,, 8 oz.	=	0	0	8¾
		£503	13	5¼ Ans

Grammar.

1. 'Two brothers once did weeping part
On the edge of the sea so blue;
The one was fair and false at heart,
The other was gallant and true.'

(*a*) Point out and parse all the verbs and adjectives in the above.

(*b*) How do you know that the words 'the one' and 'the other' in the above are not adjectives?

(*a*) *Two*—numeral adj. numbering 'brothers.'
did part—intrans. reg. verb, indic. past indef. (=parted) 3rd pers. plur. agr. with subj. 'brothers.'
weeping—irreg. trans. verb *weep, wept, wept*, incomplete part. having an adverbial force, and at the same time attributive to 'brothers.'
blue—adj. qual. 'sea.'
was—irreg. intrans. *am, was been*, indic. past indef. 3rd. pers. sing. agr. with 'the one.'
fair—predic. adj. qual. 'one.'
false— " " " 'one.'
was—same as above, agr. with 'the other.'
gallant— } predic. adjs. qual. 'the other.'
true— }

(*b*) 'the one' and 'the other' are not adjectives because they may be declined thus:—

sing.		sing.	
Nom.	one	Nom.	other
Poss.	one's	Poss.	other's
Obj.	one	Obj.	other.

We can say, 'The *one's* heart was false, and the *other's* true.' Adjectives are not declinable words.

2. What kinds of adjectives admit of comparison? What do not?

Adjectives of quality and quantity, whose signification can be increased or diminished, admit of comparison.

Adjectives of distinction, and those whose signification cannot be increased or diminished, do not admit of comparison. As: *right, left, wrong, square, two, three, this.*

Geography.

Answer either Q. 2 or Q. 3, not both.

1. What is meant by the basin of a river? Illustrate your answer by referring to the basin of the Severn, describing the counties drained by it, and naming in order its principal tributaries.

The basin is the whole area or space of ground which supplies the water to a river. It comprises not only the valley of the main river itself, but those of all the rivers and streams which run into it with all the tributaries up to the water-parting of each.

The basin of the Severn commences at Plynlimmon, and is separated from that of the Thames by the Cotswold Hills; the Edge Hills separate it from that of the Great Ouse; and the Clent Hills divide it from the basin of the Trent. On the west the basin of the Severn is bounded by the Clee Hills, the Malvern Hills, and the hilly district of the Dean Forest.

The Severn flows through Montgomery, the best wooded country in Wales, very mountainous except along the valley of the Severn; through Shropshire, a rich agricultural county abounding in coal and iron; through Worcester, a county rich in grain, salt springs, and manufactures of porcelain, carpets, etc.; and through Gloucester, a fine county, rich in grain, fruit, and pasturage, with the remains of the ancient Forest of Dean in the west, rich in coal and iron mines.

The tributaries of the Severn are the Vyrnwy, the Teme, the Avon, the Wye, the Usk, and the Lower Avon.

2. Describe minutely a voyage from Newcastle-on-Tyne to Stirling.

Leaving Newcastle, a great coal port, and passing North and South Shields, we touch Tynemouth, and turn north to Coquet Isle and Holy Island, above which are the Fern Isles, opposite Bamborough Castle, which stands upon a bold cliff south of Berwick. Berwick, at the mouth of the Tweed, was long independent of both England and Scotland. When we pass that town we are on the coast of the county of Berwick, skirting which we pass the lofty lighthouse on St. Abb's Head and Tantallon Castle, Dunbar, and round into the Firth of Forth, passing the Bass Rock, North Berwick, Prestonpans, with its salt manufacture, Musselburgh, Portobello, Leith (the Port of Edinburgh), Granton, a rival to Leith, Queensferry, Bo'ness, Grangemouth, Alloa, noted for its ales, and reach our destination, Stirling.

3. Where are the following articles made:—Silk goods, stockings, lace, gloves, needles, porcelain? Name towns as well as counties, and describe the situation of each.

Silk goods—*Spitalfields* (London); *Manchester*, on the Irwell in Lancashire; *Macclesfield*, in Cheshire; *Coventry*, in Warwick; *Derby*, on the Derwent.
Stockings—Leicester on the Soar; Derby; Nottingham, near the Trent.
Lace—Nottingham; Derby; Tiverton and Honiton, in Devonshire; Buckinghamshire.
Gloves—Worcester; Yeovil, in Somerset; Woodstock, in Oxford.
Needles—Chiefly at Redditch, in Worcestershire.
Porcelain—North of Staffordshire; Derbyshire; Leeds, on the Aire, in Yorkshire; Worcester.

Composition.

Write from dictation the passage given out by the Inspector.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Cymbeline.*

Write, in small hand, as a specimen of copy-setting, *The Turkish preparation makes for Rhodes.*

FIRST YEAR.

Pupil Teachers at the end of First Year.

Three hours and a half allowed for this Paper.

Arithmetic.

MALES.

1. Divide $2\frac{1}{4} + 3\frac{2}{3}$ of $1\frac{1}{3}$ by $5\frac{1}{2}$ of $1\frac{1}{3} - \frac{2\frac{1}{2}}{4\frac{7}{11}}$

(*a*) $2\frac{1}{4} + 3\frac{2}{3}$ of $1\frac{1}{3} = \frac{11}{4} + \frac{11\times 9}{3\times 5} = \frac{55+132}{20} = 9\frac{7}{20}$

(*b*) $5\frac{1}{2}$ of $1\frac{1}{3} - \frac{2\frac{1}{2}}{4\frac{7}{11}} = \frac{11\times 4}{2\times 3} - \frac{17\times 11}{8\times 51} = \frac{22}{3} - \frac{11}{24} = \frac{176-11}{24} = 6\frac{21}{24}$

Dividing (*a*) by (*b*) $= \frac{187\times 24}{20\times 165} = \frac{102}{170} = \frac{3}{5}$ Ans.

2. What fraction of $\frac{6\frac{1}{2}+5\frac{1}{2}}{5\frac{1}{2}-4\frac{2}{3}}$ of 3s. 4d. is 2s. $10\frac{1}{2}$d.?

(*a*) $6\frac{1}{2} + 5\frac{1}{2} = 11\frac{7}{12}$; $5\frac{1}{2} - 4\frac{2}{3} = \frac{11}{12}$

(*b*) $11\frac{7}{12} \div \frac{11}{12} = \frac{139\times 24}{12\times 11} = 25\frac{9}{11}$

(*c*) $\frac{2\text{s. }10\frac{1}{2}\text{d.}}{25\frac{9}{11}}$ of 3s. 4d. $= \frac{139 \text{ fars.} \times 11}{160\times 278} = \frac{11}{320}$ Ans.

3. Give a rule for finding the decimal point in dividing one decimal by another.

Divide 29·5625 by 6·25; ·295625 by 625; and 295625 by ·625.

Rule.—Divide as if the divisor and dividend were whole numbers. If the number of places in the dividend exceed the number in the divisor, cut off from the quotient as many decimal places as are equal in number to this excess, prefixing ciphers if necessary.

If the number of places in the dividend is less than the number of places in the divisor, affix ciphers to the dividend until the number of places in the dividend equals the number of places in the divisor; the quotient up to this point of the division will be a whole number; if there be a remainder, and the division be carried on further, the figures in the quotient after this point will be decimals.

(*a*)

6·25)29·5625(4·73 Ans.
25 00
4 562
4 375
1875
1875

(*b*)

625)·295625(·000473 Ans.
2500
4562
4375
1875
1875

(*c*)

·625)295625(473000 Ans.
2500
4562
4375
1875
1875

4. Express $1\frac{1}{4}$ of £1 17s. 10½d. as the decimal of £5, and find the value of ·428571 of $2\frac{1}{2}$ guineas.

(*a*) $\frac{\frac{5}{4} \text{ of £1 17s. 10½d.}}{£5} = \frac{\frac{5}{4}\frac{8}{8}}{5} = \underline{·606}$. Ans.

(*b*) ·428571 of 52½s. $= \frac{3 \times 105}{7 \times 2} = \underline{22\text{s. } 6\text{d.}}$ Ans.

5. Show that $\frac{·72\dot{9} \times 1·34\dot{5}}{·02\dot{7} \text{ of } 2·08\dot{3}} = 17·28$.

$$(\tfrac{7}{9}\tfrac{2}{9}\tfrac{9}{9} \times 1\tfrac{4}{9}\tfrac{5}{9}\tfrac{2}{9}) \div (\tfrac{2}{9}\tfrac{7}{9}\tfrac{7}{9} \times 2\tfrac{7}{9}\tfrac{5}{9}\tfrac{5}{9})$$
$$= \frac{729 \times 1332 \times 990 \times 900}{999 \times 990 \times 27 \times 1875}$$
$$= \frac{432}{25} = \underline{17·28}. \text{ Ans.}$$

FEMALES.

1. A person's salary is £383 5s. for 365 days; in how many days will he have a claim for £63?

£383¼ : £63 :: 365 days : ?

$\frac{365 \text{ das.} \times 252}{1533} = \underline{60 \text{ days.}}$ Ans.

2. A bankrupt having £645 5s. 3½d. left, can pay seven shillings and eight pence halfpenny in the pound. What is the amount of his debts?

7s. 8½d. : £645 5s. 3½d. :: £1 : debts.
or or
185 halfd. 309727 halfd.

$\frac{£1 \times 309727}{185} = \underline{£1674\ 4\text{s.}}$ Ans.

3. If 16 men, working 8 hours a day, can reap 9 acres in 3 days, how much land can 20 men, working 6 hours a day, reap in the same time?

16 men : 20 men
8 ho. : 6 ho. } :: 9 ac. : ?

$\frac{9 \text{ ac.} \times 20 \times 6}{16 \times 8} = \frac{135 \text{ ac.}}{16} = \underline{8 \text{ ac. } 1 \text{ ro. } 30 \text{ po.}}$ Ans.

4. 6 horses eat 18 guineas' worth of hay in 6 weeks when hay is 9d. a stone, what is its price per stone when 15 horses eat £110 5s. worth in 21 weeks?

15 horses : 6 horses
378s. : 2205s.
21 wks. : 6 wks. } :: 9d. : ?

$\frac{9\text{d.} \times 6 \times 2205 \times 6}{15 \times 378 \times 21} = \underline{6\text{d.}}$ Ans.

Grammar.

1. 'Not wholly in the busy world, nor quite
Beyond it, blooms the garden that I love;
News from the humming city comes to it,
In sound of funeral or of marriage bells;
Although between it and the garden lies
A league of grass, washed by a slow, broad stream,
That stirred by languid pulses of the ear,
Waves all its lazy lilies.' TENNYSON.

(*a*) Point out all prepositions in the above, and show what words they govern.

(*b*) Parse the word 'that' as it is used in the second and seventh lines.

(*c*) Which words in the above are adverbs? Show that they are such.

PREPOSITIONS.

(*a*) *In*	gov.	'world'	*of*	gov.	'bells.'
beyond	,,	'it'	*between*	,,	'it' and 'garden.
from	,,	'city'	*of*	,,	'grass.'
to	,,	'it'	*by*	,,	'stream.'
in	,,	'sound'	*by*	,,	'pulses.'
of	,,	('bells')	*of*	,,	'ear.'

(*b*) 'that' in second line is a simple rel. pron. referring to 'garden,' 3rd pers. sing., neut. obj. gov. by 'love.'
'that' in seventh line is a simple rel. pron. refer. to 'stream,' 3rd pers. sing., neut. nom. subj. of 'waves.'

(*c*) '*Not*' is an adverb, because it modifies another adv., 'wholly.'

Rule:—Adverbs modify verbs, adjectives, and other adverbs.

'wholly,' adv., because it modifies the verb 'blooms.'
'quite' ,, ,, ,, the adverb phrase 'beyond it.'

2. The words *except*, *notwithstanding*, are sometimes used as prepositions, sometimes as conjunctions. Give examples of their use in each capacity.

'They all perished *except* one' (prep.)
'*Except* ye repent, ye shall all likewise perish' (conj.).
'*Notwithstanding* his good character, they dismissed him' (prep.).
'The loss of a few ounces of blood may do no harm, *notwithstanding* it will weaken a person at the time' (conj.).

Geography.

Answer either Q. 2 or Q. 3, not both.

1. Draw a full map of Russia in Europe. Insert the lines of latitude and longitude.

2. What is a river-basin? Illustrate your answer by referring to the basins of the Severn and the Danube, describing minutely the courses of those rivers, and their principal tributaries.

The basin is the whole area or space of ground which supplies the water to a river. It comprises not only the valley of the main river itself, but those of all the rivers and streams which run into it, with all the tributaries up to the waterparting of each.

The basin of the Severn commences at Plynlimmon, and is separated from that of the Thames by the Cotswold Hills; the Edge Hills separate it from that of the Great Ouse; and the Clent Hills divide it from the basin of the Trent. On the west the basin of the Severn is bounded by the Clee Hills and the hilly district of the Dean Forest.

Rising in Plynlimmon, the Severn flows almost due north through the vale of Montgomery until it enters the plain of Salop, where it is joined by the *Tern*, flowing from Staffordshire. The Severn now turns to the south and flows through a valley bounded on one side by the Wrekin and Clent Hills, and on the other by the Clee and Malvern Hills. It is now joined by the waters of the Stour and Teme. The Teme rises in Plynlimmon and has a quick descent to the main stream. Soon after entering Gloucestershire it receives the Avon, which rises at Naseby, in Northampton, and joins the Severn after a course of 100 miles. The course of the Severn is now very winding as far as Gloucester, where it meets the tide.

The basin of the Danube, which embraces an area of nearly 300,000 square miles, is bounded by the Alps, the Balkans, the Carpathians, the Riesen-gebirge Mountains, the Bohemian Forest, and the Schwartz Wald.

The Danube from the heights of the Black Forest in Baden flows eastward through Hohenzollern, Wirtemberg, Bavaria, and Archduchy of Austria, E. and S. through Hungary, and enters Turkish territory at Belgrade. It continues E., forming the boundary of Turkey, separating Servia from Hungary, and Bulgaria from Wallachia, and falls into the Black Sea.

It receives on its right the Iller, the Leck, the Iser, and the Inn, all from the Tyrolese Alps; the Drave from the E. of the Tyrol, and the Save from Carinthia; it receives on its left bank

the Naab from the Bohemer Wald, the Morava from Moravia, the Waag from the borders of Silesia, and the Theiss from the Carpathian Mountains. In Turkey it receives the Morava from Servia, the Isker from Sophia, and the Pruth from Buckovina.

3. Say what you know about the government of the different countries of Europe; and explain the terms, *Absolute Monarchy, Limited Monarchy, Republic, Confederation.*

The form of government is in general *Limited* Monarchy; the exceptions are Russia and Turkey, which are *Absolute*, Austria being nearly so; France is a *Republic*, and Switzerland a *Federal Republic.*

A Limited Monarchy is a country governed by a king or queen, whose acts are controlled by laws made by an assembly of national representatives, like the British Parliament.

An Absolute Monarchy is a country whose ruler is not limited by any controlling assembly.

A Republic is a country governed by rulers chosen by their fellow-citizens, the chief ruler being generally styled President.

A Federal Union or Confederation is a union of several independent states for the purpose of better securing common interests, each state managing its own internal affairs independently of the others.

History.

1. How many kings named William have governed England? Gives dates of their accession and death.

Four kings of the name of William have governed England, namely:—

William	I. began to reign	1066	died 1087
William	II. ,,	1087	,, 1100
William	III. ,,	1689	,, 1702
William	IV. ,,	1830	,, 1837

2. Name the queens who have reigned in England, with the length of each reign.

Mary I.	reigned for	5 years	(1553-58)
Elizabeth	,, ,,	45 ,,	(1558-1603)
Mary II.	,, ,,	5 ,,	(1689-94)
Victoria has	,, ,,	45 ,,	(1837-82)

3. Give names and dates of the sovereigns who reigned between 1460 and 1550.

Henry VI.	was reigning	1460	deposed	1461.
Edward IV.	reigned from	1461	till	1483.
Edward V.	reigned for a few months in			1483.
Richard III.	,, from	1483	till	1485.
Henry VII.	,, ,,	1485	,,	1509.
Henry VIII.	,, ,,	1509	,,	1547.
Edward VI.	,, ,,	1547	,,	1553.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Cymbeline.*

Write, in small hand, as a specimen of copy-setting, *The Turkish preparation makes for Rhodes.*

Composition.

Write from memory the substance of the passage read to you by the Inspector.

SECOND YEAR.

Pupil Teachers at end of Second Year.

Three hours and a half allowed.

Arithmetic.

MALES.

1. At what rate per cent., simple interest, will £375 12s. 6d. amount to £460 2s. 9½d. in 5 years?

Interest = (£460 2s. 9½d. − £375 12s. 6d.) = £84 10s. 3½d.

$$\left.\begin{matrix} £375\tfrac{1}{2} : £100 \\ 5 \text{ yrs.} : 1 \text{ yr} \end{matrix}\right\} :: £84\ 10s.\ 3\tfrac{1}{2}d. : \text{rate}$$

$$\frac{£84\ 10s.\ 3\tfrac{1}{2}d. \times 100 \times 8}{3005 \times 5} = £4\tfrac{1}{2} \text{ p.c. Ans.}$$

2. Find the compound interest on £2,533 6s. 8d. for 2½ years at 3 per cent. per annum.

3 p. c. per annum gives $\frac{3}{100}$ of principal for interest to be added at the end of each year, and $\frac{1}{100}$ for one-third of a year.

$\frac{100}{100}$	2,533	6	8	
	76			
$\frac{1}{100}$	2609	6	8	Amount for 1st year
	78	5	7·2	
$\frac{1}{100}$	2687	12	3·2	,, ,, 2nd ,,
	26	17	6·272	
	2714	9	9·472	,, ,, 2½ years.
deduct	2533	6	8	

Compound interest = £181 3 1·472 Ans.

3. On what sum of money will the simple interest in 3 years 219 days at 4 per cent. per annum amount to £685 8s. 9½d.?

$$\left.\begin{matrix} £4 : £685\ 8s.\ 9\tfrac{1}{2}d. \\ 3\tfrac{1}{2} \text{ years} : 1 \text{ year.} \end{matrix}\right\} :: £100 : \text{Sum required.}$$

$$\frac{£685\ 8s.\ 9\tfrac{1}{2}d. \times 100 \times 5}{4 \times 18} = £4760 \text{ Ans.}$$

4. A money-lender gets 15s. for the loan of £24 for 5 calendar months. What rate per cent. per annum does he get for his money?

$$\left.\begin{matrix} £24 : £100 \\ 5 \text{ mos} : 12 \text{ mos} \end{matrix}\right\} :: £\tfrac{3}{4} : \text{rate}$$

$$\frac{£3 \times 100 \times 12}{4 \times 24 \times 5} = 7\tfrac{1}{2} \text{ p.c. Ans.}$$

5. What percentages of 5 are 20, 3½, ·02, and 1½?

$$5 : 100 :: \left\{\begin{matrix} 20 \\ 3\tfrac{1}{2} \\ \cdot 02 \\ 1\tfrac{1}{2} \end{matrix}\right\} : \left\{\begin{matrix} 400. \text{ Ans.} \\ 70. \text{ Ans.} \\ \tfrac{1}{2}. \text{ Ans.} \\ 26\tfrac{1}{2}. \text{ Ans.} \end{matrix}\right.$$

FEMALES.

1. Find the least common multiple of 225, 255, 289, 1023, and 4095.

5	225,	255,	289,	1023,	4095.
3	45	51			819
3	15	17		341	273
17	5				91
		1	17		

∴ L.C.M. = 5 × 3 × 3 × 17 × 5 × 17 × 341 × 91
= 2,017,790,775. Ans.

2. Reduce the following compound fraction to a simple one: ⅘ of ¾ of ⅞ of 70⅔ of $\frac{4}{15}$ of $1\frac{7}{11}$ of 147

$$\tfrac{4}{5} \text{ of } \tfrac{3}{4} \text{ of } \tfrac{7}{8} \text{ of } 70\tfrac{2}{3} \text{ of } \tfrac{4}{15} \text{ of } 1\tfrac{7}{11} \text{ of } 147 = \frac{5 \times 3 \times 6 \times 632 \times 3 \times 18 \times 147}{7 \times 8 \times 7 \times 9 \times 40 \times 11} = 81\tfrac{9}{11}$$

3. Divide $3\frac{1}{2} - \frac{3}{4}$ of $\frac{4}{15}$ by $21\frac{1}{2} + \frac{5}{16} + 4\frac{1}{2}$ of 5

(*a*) $3\frac{1}{2} - \frac{3}{4}$ of $\frac{4}{15} = \frac{7}{2} - \frac{3}{5} = \frac{117 - 8}{36} = \frac{109}{36}$

(*b*) $21\frac{1}{2} + \frac{5}{16} + 4\frac{1}{2}$ of $5 = 21\frac{1}{2} + \frac{5}{8} = \frac{129 + 130}{6} = 21\frac{2}{3}$

(*c*) $\frac{109}{36} \div 21\frac{2}{3} = \frac{109 \times 6}{36 \times 259} = \frac{109}{1554}$. Ans.

4. What fraction of a sovereign is $4\frac{1}{4} - 10\frac{1}{2} + 9\frac{1}{8} - \frac{19}{170}$ of a penny?

(*a*) $4\frac{1}{4} + 9\frac{1}{170} = 13\frac{10}{17} \frac{1}{10} = 13\frac{1}{17}$; $13\frac{1}{17} - 10\frac{1}{2} = 13\frac{1}{17} - 10\frac{1}{2} = 2\frac{1}{17}$; $2\frac{1}{17} - \frac{1}{2} = 2\frac{42 - 20}{45} = 2\frac{22}{45}$.

(*b*) $2\frac{22}{45}$d. to the fraction of a sov. = £$\frac{112}{45 \times 240}$ = £$\frac{7}{675}$. Ans.

Grammar.

1. 'It is not *dying* for a faith *that* is *so hard*, *but* living *as if* it *were* a *reality* to us.'

(*a*) Analyse the subordinate sentences in the above, pointing out to which class each belongs.
(*b*) Parse the words in italics.
(*c*) Show from the above what kind of conjunctions are followed by the subjunctive mood, and give other examples.

(*a*) (1) 'That is so hard' subord. adj. sent. qual. the fact 'dying for a faith.'
(2) 'As if it were a reality to us,' subord. adv. sent. modif. 'living.'

	(1)	(2)
Subject	'*that*' and	'*it.*'
Predicate (incomplete)	'*is*' ,,	'*were.*'
Completion of Pred.	'*so hard*' ,,	'*a reality to us.*'
Connective	'*that*' ,,	'*as if.*'

(*b*) *dying*—verbal noun or gerund. nom. after 'is' in apposition with 'it.'
that—simple rel. referring to 'dying for a faith,' sing., neut., nom., subj. of 'is.'
so—adv. of deg. mod. 'hard.'
hard—predic. adj. qual. 'that.'
but—advers. co-ord. conj. contrasting the two principal members of the compound sentence.
as if—conj. phrase, or compound subord. conj. of condition connecting a subord. sent. to a principal.
were—irreg. intrans. verb, *am*, *was*, *been*, subjunctive, past indef., 3rd pers. sing., agr. with subj. 'it.'
reality—abstr. noun, neut., sing., nom. after 'were.'
(*c*) The subjunctive mood is generally used after hypothetical or conditional conjunctions: *e.g.*, '*as if* it were a reality'; 'I fear *lest* he come'; 'except he give us permission we dare not go.'

2. Distinguish between (present) participles and gerunds; give some examples of the use of the latter.

The (present) participle always qualifies a noun either attributively or predicatively, and the gerund or verbal noun, though also ending in -ing denotes action or state, and may be used as the subject or object of a sentence. It may also govern an objective case.

Participles.	*Gerunds.*
A *rolling* stone.	The *rolling* of the ship.
A *running* sore.	In *running* along.
The *gleaming* sun.	The *gleaming* of the sun.

Geography.

Answer two Questions.

1. Draw a full map of Russia in Europe. Insert the lines of latitude and longitude.

2. Give full notes of a lesson on Malta.

POSITION.—Situated in the Mediterranean, 58 miles S. of Sicily, and 179 miles from the N. point of Africa.
EXTENT AND CHARACTER.—Little else than mere rock—stretches from N.W. to S.E.—length 18 miles—greatest breadth 10 miles—area about 95 sq. miles—about two-thirds cultivated—most of it made productive by sheer industry—climate excellent, allowing two crops every year—no streams—few springs—rain-water collected in tanks.
TOWNS AND PEOPLE.—*Valetta*, on N.E. coast (60,000), clean, handsome town, with one of the finest harbours in the world—very strongly fortified—a port of call for vessels to India. *Maltese*, strong and hardy—make excellent seamen—famous for making lace and jewellery—speak an Arabic dialect—are Roman Catholics.
PRODUCTIONS.—No forest trees or hedges—wild thyme in the west feeds bees, which produce famed Maltese honey—whole crop of corn lasts inhabitants only three months. *Cotton* is the chief production. Vines and olives are cultivated, figs and oranges abound, and the vegetables are excellent. The asses of Malta are celebrated.
IMPORTANCE.—From its position, commercial and military, it can scarcely be over-valued. Commanding the southern coast of Europe, it is the rendezvous for the British fleet stationed in the Mediterranean, and along with Gibraltar prevents the closing of the route to our Indian possessions.
HISTORY.—Possessed by the Knights of St. John from 1530; it was taken by the French in 1798, and these again were driven out by the English in 1800, from which time it has remained a British possession.

3. Say what you know about British Columbia, the Mackenzie, the Great Slave Lake, Melville Sound, Hudson Straits, Baffin's Bay, and Cape Sable.

N.B.—If you do *not* answer Q. 1, draw little sketch-maps in illustration of 2 or 3.

British Columbia is a colony of British North America, forming part of the Dominion of Canada. The climate is somewhat similar to Britain, and its soil is well suited for agriculture. The country is well wooded and mountainous. New Westminster is an important town on the Fraser river.
The Mackenzie (and Athabasca united) rises in the Rocky Mts., flows N. and N.W. through British America, and falls into the Arctic Ocean. Their united length is 2,300 miles, and area of basin 600,000 sq. miles.
On this river are the three great expansions of Athabasca, Slave, and Great Bear Lakes.
The Great Slave Lake is an expansion of the Mackenzie River, in British North America, about 300 miles long.
Melville Sound is one of a line of straits leading from Baffin's Bay westward to the Arctic Ocean.
Hudson Straits connect Hudson Bay with the Atlantic.
Baffin's Bay is a large inland sea between the N.E. shores of North America and the W. coast of Greenland, opening into the Atlantic by Davis' Strait, and into the Polar Sea by Lancaster Sound, etc.
Cape Sable is the southernmost point of Nova Scotia.

SECOND PAPER.

Two hours and a half allowed.

History.

1. Who was Stephen? Who disputed the throne with him, and upon what grounds? Which do you consider to have had the better right to it?

Stephen was the son of Adela, a daughter of William the Conqueror, and hence the nephew of Henry I.
On Henry's death he usurped the crown, in defiance of an oath of fealty which he had sworn to Maud, the daughter of Henry I. She, on her return to England, after the death of her husband the Emperor Henry V., had been declared by her father heir to all his territories. Maud, then, had undoubtedly the better right to the crown.

2. Who was Richard I.? How came he to be so long absent from England, and how was the country governed during the king's absence?

Richard I., surnamed Cœur de Lion, was son and successor to Henry II. Shortly after the beginning of his reign he joined the Third Crusade, and along with the French king he set out for the Holy Land. The crusade kept him long absent from England, and during his absence the country was governed, first by the Chancellor, William of Longchamp, Bishop of Ely. He being removed was succeeded by Walter, Archbishop of Rouen. The King's brother John, who was mainly the cause of the Chancellor's removal, was declared Regent and heir to the crown. But the Archbishop and the Queen-mother mistrusting John prevented him from getting any real power. He continued to plot against his brother till Richard returned, when he was merely deprived of his lands and castles.

3. Name the locality nearest to your home which is famous for a battle fought before 1486. Describe the parties to that contest and its issue.

In 1485 Richard III., the last of the Plantagenets, was defeated and killed at Bosworth (Leicestershire) by Henry (Tudor) VII., which put an end to the civil wars between the Houses of York and Lancaster.

Composition.

Write full notes of a lesson on *The Oak*.

ARTICLES TO BE SEEN.—*Oak-leaf—oak-bark—piece of trunk—acorn—untanned leather—tanned leather—picture of tree, for children who cannot see the real thing.*

DESCRIPTION.—Noble object in a landscape—king of trees—long-lived—of great size—stands the storm—roots firm in the ground, and go a great depth—grows naturally in England—two kinds—one less firm and durable—the other has wood tough, hard, durable, no insect can pierce it—age known by counting the rings in trunk (*explain why*)—gall nuts found on leaves—oak tree best cut when it is over seventy or eighty years of age—fruit called acorns.

WHERE FOUND.—Grown in England, in forests belonging to the Crown—common in Spain, France, Portugal, Russia, Norway, Sweden, Scotland, Canada, India, etc. The English forests are—New Forest, Epping, Dean, and Sherwood.

USES.—Used wherever strength and durability are required—especially for ships—for furniture, carvings in churches, for roofs—all old buildings have oak roofs. *Oak-sawdust* used as one of the chief ingredients in dyeing the different shades of brown and drab colour. *Oak-bark* employed for tanning leather, for fuel, and manure. *Acorns* used for feeding pigs; formerly eaten by the peasantry of this country, and still eaten in Spain and Asia Minor. *Gall-nuts* used in dyeing black.

HISTORICAL NOTES.—Venerated by the Druids—William Rufus met his death by an arrow glancing from an oak—Charles II. concealed himself in an oak at Boscobel.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Cymbeline.*

Write, in small letters, as a specimen of copy-setting, *The Turkish preparation makes for Rhodes.*

Euclid.

MALES.

[All generally understood abbreviations for *words* may be used.]

1. If two straight lines cut one another, the vertical, or opposite angles shall be equal.

Prop. 15, Bk. I.

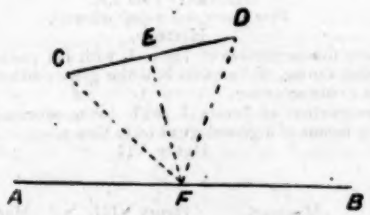
2. At a given point in a given straight line, to make a rectilineal angle equal to a given rectilineal angle.

Prop. 23, Bk. I.

3. Find a point in a given straight line such that its distances from two given points may be equal.

Let AB be the given straight line and C, D, the two given points. Join CD and bisect CD in E. From E draw EF perpendicular to CD and produce it to meet AB in F. F is the point required.

Join CF, DF.



Because CE = ED, and EF is common to the two triangles CEF, DEF, and the angles at E are right angles, then by Prop. 4, Bk. I. CF = DF, that is, the point F is equidistant from C and D.

This problem is impossible when the line joining the two points is perpendicular to the given line.

Any point in the given line will fulfil the conditions of the problem, when the given points are perpendicularly equidistant from the given line either on the same, or on opposite sides of it.

THIRD YEAR.

Pupil Teachers at end of Third Year, *if apprenticed on, or after, 1st May,* **1878; and Pupil Teachers at end of Fourth Year,** *if apprenticed before that date.*

Three hours and a half allowed.

Arithmetic.

MALES.

1. If a grocer buys cheese at £4 13s. 4d. per cwt., how must he sell it per lb. to gain 15 per cent. on his outlay?

£4 13s. 4d. ÷ 112 = 10d. the price of 1 lb.
100 : 115 :: 10d. : 11½d. Ans.

2. If by selling tea at 3s. 6d. per lb. a grocer gains 12 per cent., how much per cent. would he gain or lose by selling it at 3s. per lb.?

42d. : 36d. :: 112 : 100 + or −

$$\frac{112 \times 36}{42} = 96$$

That is, he only gets 96 parts out of the hundred.
∴ he loses 4 p.c. Ans.

3. A man derives an income of £108 by investing £3595 10s. in the 3 per cents. What is the price of stock?

£108 : £3 :: £3595 10s. : price of stock.

$$\frac{£3595{\cdot}5 \times 3}{108} = 99\tfrac{7}{12}.$$ Ans.

4. A invests £6000 in one railway stock at 108, paying a dividend of 4 per cent.; and B invests £5000 in another railway stock at 75, paying a dividend of 2¾ per cent. What is the difference in the annual income derived?

	£	s.	d.	
£6000 × 4/108 =	222	4	5½	A's. income.
£5000 × 2¾/75 =	183	6	8	B's. ,,
diff. of income =	38	17	9½	Ans.

5. Divide £1746 amongst A, B, and C, so that B may have 50 per cent. more than A, and C 33⅓ per cent. more than B.

Let A have 2 parts,
then B has 3 ,,
and C ,, 4 ,,
Total 9 ,,

	£	
Hence A's share = 2/9 of 1746 or	388.	Ans.
,, B's ,, = 3/9 ,, ,,	582.	Ans.
,, C's ,, = 4/9 ,, ,,	776.	Ans.

FEMALES.

1. Find the value of ·007 × 700 × 760·3 × ·00416 × 100,000.

·007 × 700 = 4·9
4·9 × 760·3 = 3725·47
3725·47 × ·00416 = 15·4979552
15·4979552 × 100000 = 1549795·52. Ans.

2. Find the quotient of ·7575 by 16¾.

·7575 ÷ 16¾ = ·7575 ÷ 67/4
$= \frac{2{\cdot}2725}{50} = {\cdot}04545.$ Ans.

3. Find the value of ·972916 of £1.

£·972916 = 19s. 5½d. Ans.
20
19·4583s.
12
5·5d.

4. Find the value of the following expression:—·68125 of £1 + ·375 of 13s. 4d. + ·605 of £3 2s. 6d.

	£	s.	d.
£·68125	= 0	13	7½
·375 of 13s. 4d.	= 0	5	0
·605 of £3 2s. 6d.	= 1	17	9½
	2	16	5½ Ans.

Grammar.

1. 'And now *farewell*. I am *going* a long *way*
To the island valley of Avilion;
Where falls not *hail*, or rain, or *any* snow,
Nor ever wind blows loudly, but it lies
Deep-meadowed, happy, fair with orchard lawns,
Where I will *heal me* of my grievous *wound*.'

TENNYSON.

(*a*) Give an example from the above of a simple predicate, of a predicate with its complement, and of a predicate with its extension.

(*b*) Parse the words in italics.

(*c*) 'An adjective sentence is sometimes introduced by a relative adverb;' give an example of this from the above.

(*a*) 'Falls' is a simple predicate; 'of my grievous wound' is the complement of the predicate 'heal'; 'ever' and 'loudly' are extensions of the predicate 'blows.'

(*b*) '*farewell*'—(= may you fare well) an expression of courtesy now used interjectionally, equivalent to a noun governed by such a verb as 'bid.'
going—incomplete part. of *go*, *went*, *gone*, forming part of the progress. form of the verb 'go.'
way—abstr. noun, neut., sing., obj. of distance.
where—subord. abverb. conj., modif. 'falls.'
hail—com. noun, neut., sing., nom., subj. of 'falls.'
any—indef. adj., qual. 'snow.'
deep-meadowed—predic. adj., qual. 'it.'
heal—reg. trans. verb, infin., pres., indef., gov. by 'will.'
me—(= myself) emph. pron., 1st pers., sing., mas. (or fem.), obj., gov. by 'heal.'
wound—com. noun, neut., sing., obj., gov. by 'of.'

(*c*) 'Where falls not hail,' etc., is an adj. sent., qual. 'Avilion.'

2. Point out the Latin preposition in each of the following words, and give the meaning of each preposition, and of the word with which it is compounded—*superfluous*, *extra-mural*, *percolate*, *cisatlantic*.

superfluous	is compounded of	'super' above, and 'fluere' to flow.
xtra-mural	,,	,,	'extra' beyond, and 'murus' a wall.
percolate	,,	,,	'per' through, and 'colare' to filter.
cisatlantic	,,	,,	'cis' on this side, and 'Atlantic' the Atlantic Ocean.

Geography.

Answer either Q. 2 or Q. 3; not both.

1. Draw a map of Lower Egypt; showing the positions of Alexandria, Cairo, Damietta, Rosetta, Port Said, Ismailia, Suez, and the two mouths of the Nile. Insert the lines of latitude and longitude.

2. Give notes of a lesson on Japan and the Japanese.

Lesson to be given before a map of Asia.

I. JAPAN.—(1) *Position.*—Japan is situated in the Pacific Ocean, N.E. of the great Chinese Empire; occupies the space between the southern extremity of the Peninsula of Kamtchatka and the Peninsula of Corea.

(2) *Parts.*—It consists of a number of islands, the principal being Yesso, Niphon, Sikok, and Kiu-Siu.

(3) *Extent.*—Total area about 155,000 square miles.

(4) *Surface.*—Bold and picturesque; traversed by chains of mountains, running north and south; some of the summits are active volcanoes; rivers are short and rapid; soil fertile; coast abounds with magnificent harbours.

(5) *Climate.*—Varies with the latitude; in north it resembles that of England; in southern islands it is as warm as that of France or Italy.

(6) *Productions.*—Flowers and fruits abundant and rich; birds numerous; seas abound with fish; country rich in minerals, chief one being copper, but gold, silver, iron, and sulphur also found; coal is abundant. Of native trees, the most remarkable are the *varnish-tree*, whose juice is used in lacquering furniture; the *camphor-tree*, the *paper-mulberry*, and the vegetable *wax-tree*. Domestic animals are scarce. Rice, wheat, and other cereals; cotton and tobacco plants; the tea-shrub and potato are diligently cultivated.

(7) *Trade and Commerce.*—Internal trade very considerable, and there are regulations in force to protect and encourage native industry. Railways and telegraphs have been introduced, and lighthouses erected round the coasts. Foreign commerce much encouraged, the chief exports being copper, camphor, tea, silk, lacquered goods, porcelain; the chief imports, sugar, coffee, spices, lead, tin, iron ware, and cotton goods.

(8) *Chief Towns.*—Yeddo, Yokohama, Kioto, Osaka, Nangasaki, Hakodadi, and Matsumai.

II. JAPANESE.—Belong to the Mongolian family of nations; differ frome the Chinese in language and character; they are persevering, courageous, and frank; clean, sober, and contented; open to the influences of Western civilization, readily adopting the manners and customs of Europe.

Their food consists of rice, vegetables, and fish, and they abstain religiously from animal food; tea is the universal drink.

European artizans have been employed to instruct the natives: numbers of the nobility have been sent to Europe to improve their education; there are common schools, and colleges with European professors.

The Japanese are skilful in making cotton and silk fabrics, in lacquering or 'japanning'; they display great ingenuity in working metals and cabinet work; in adapting paper to various uses—this material, made from the bark of the mulberry-tree, is wrought into cigar-cases, trunks, saddles, towels, etc.

3. Say what you know about Trichinopoly, the Neilgherry Hills, Seringapatam, Hyderabad, the Godavery, the Krishna, and the Nerbudda.

Trichinopoly is a city and fortress of British India, in the Presidency of Madras, on the river Cauvery. It has a large pagoda, and is celebrated for the manufacture of chains and jewellery.

Neilgherry Hills are a cluster of hills formed by the union of the Eastern and Western Ghauts in the south of the plateau of the Deccan.

Seringapatam is a strong town of Mysore in British India, formerly the capital of the province under Hyder Ali and Tippoo Sahib. It stands on an island formed by the Cauvery, and was taken by the British in 1799.

Hyderabad.—There are two cities of this name in India; one in the Bombay Presidency, near the Indus, and noted for the manufacture of lacquered snuff-boxes; another, capital of Nizam's dominions, in a barren district. It is distinctly a Mussulman city, and the principal mosque is a model of the Kaaba, at Mecca.

The Godavery rises near the northern extremity of the Western Ghauts. Its chief feeder is the Pranheta. It traverses nearly the whole breadth of the Indian peninsula, and falls by several mouths into the Bay of Bengal, after flowing 900 miles. There are few important towns on this river, but the forests along its banks supply excellent timber.

The Kistna or *Krishna* rises in the Western Ghauts, flows south and then eastward, and empties itself into the Bay of Bengal, by a delta which almost unites with that of the Godavery.

The Nerbudda, 800 miles long, rises in the British district of Ramguth, flows west between the Vindhya and Sautpoora Mountains. Its current is obstructed by rocks and shallows, and its banks clothed with dense jungle. It has fewer windings than most Indian rivers.

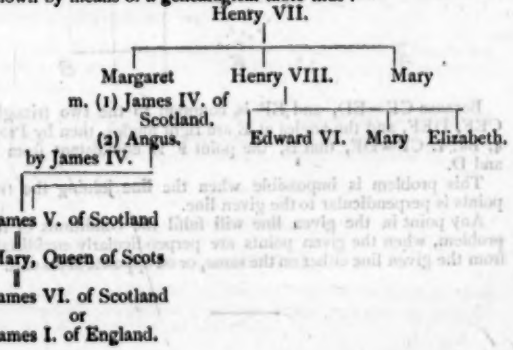
SECOND PAPER.

Two hours and a-half allowed.

History.

1. Show the connection of James I. with his predecessors on the English throne, and explain how the great parties here came to assent to his accession.

The connection of James I. with his predecessors is best shown by means of a genealogical table thus:—



His predecessors on the English throne were *Elizabeth*, *Mary*, *Edward VI.*, children of his great-grand-uncle, *Henry VIII.*

The three great parties assented to his accession, because they all looked for support from him; the English Puritans hoped for support because their views strongly resembled the Presbyterians of Scotland; the Roman Catholics relied upon the mildness James had always shown towards the Scotch Roman Catholics; the Episcopalians rejoiced in the accession of a sovereign who had warmly embraced their cause.

2. Give dates and localities of any battles fought since 1486 in the county where you live, or in an adjoining county. Describe the parties engaged in one of them with its result.

The Battle of Stoke was fought in 1487, near Newark in Nottinghamshire, when Lambert Simnel was defeated by the forces of Henry VII.

The Battle of Flodden was fought in 1513, near Wooler, in Northumberland, when James IV. of Scotland was defeated and slain by the troops of Henry VIII., under the Earl of Surrey.

A battle was fought at Solway Moss, in Cumberland, on the Scottish Border, 1542, when the troops of James V. were ignominiously routed by the troops of Henry VIII.

The following battles may be noted: *Edgehill* (in Warwickshire, near the Oxford border, 1642); *Chalgrove* (Oxfordshire, near Oxford, 1643); *Newbury* (Berkshire, 1643-44); *Marston Moor* (near York, 1644); *Naseby* (near Northampton, 1645); *Preston* (in Lancashire, 1648); *Sedgemoor* (in Somerset, near Bridgewater, 1685).

3. When was the Legislative Union of Great Britain and Ireland effected? Describe events which led to it.

The Legislative Union of Great Britain and Ireland was effected on 1st January, 1801.

During the war of the French Revolution the United Irishmen entered into treasonable correspondence with France, from which more than one expedition was sent to their aid. Of these the most formidable, under General Hoche, was scattered by a tempest in 1796; another in 1798 made its way into Longford, where it was forced to surrender, while the United Irishmen were routed at Vinegar Hill, in Wexford. Of the chiefs of the conspiracy, Lord Edward Fitzgerald died of the wounds received while defending himself from arrest, and Wolfe Tone killed himself. After the insurrection had been quelled, the Irish Parliament, which had been independent of the British House since 1782, ceased to exist January 1st, 1801, and thenceforth Ireland sent her representatives to Westminster.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Cymbeline*.

Write, in small hand, as a specimen of copy-setting, *The Turkish preparation makes for Rhodes.*

Composition.

Write from memory the substance of the passage read to you by the Inspector.

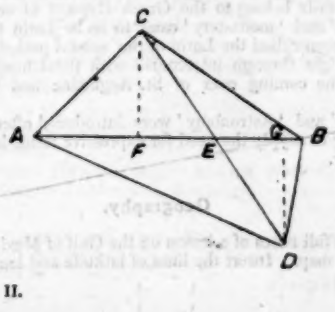
Euclid.

MALES.

[All generally understood abbreviations for *words* may be used.]

1. If a quadrilateral figure be bisected by one diagonal, the second diagonal is bisected by the first.

Let the quadrilateral ACBD be bisected by the diagonal AB, (that is, the triangle ACB or ADB is the half the figure,) then if the other diagonal CD be drawn, it will be bisected by AB, namely, where they cut each other in E.



Since the triangles ACB, ADB are equal, and stand on opposite sides of the same base, it is evident that their altitudes (that is, the perpendicular from the vertex upon the base) must be equal, for if on the same side of the base they would be between the same parallels. Therefore, the perps. CF, DG, are equal, and the angles at F and G are equal, as also the vertical angles at E.

Wherefore, by 26th prop., Bk. I., the triangles CFE, DGE, are equal in every respect, and therefore CE = ED.

Q. E. D.

2. Any two angles of a triangle are together less than two right angles.

Prop. 17, Bk. 1.

3. If a side of any triangle be produced, the exterior angle is equal to the two interior and opposite angles, and the three interior angles of every triangle are together equal to two right angles.

Prop. 32, Bk. I.

Algebra.

1. Simplify $(a+b)^2-(b+a)(a-b)-\{a(2b-2)-(b^2-2a)\}$

$$\begin{aligned}(a+b)^2 &= a^2+2ab+b^2\\ -(b+a)(a-b) &= -a^2\quad\quad +b^2\\ -\{a(2b-2)-(b^2-2a)\} &= 2a-2ab+b^2-2a\end{aligned}$$

by addition we get $\underline{2b}$ Ans.

2. Find the G. C. M. of $x^2-7x+10$ and $4x(x^2+10)-25x-62$

$x^2-7x+10=(x-5)(x-2)$

$4x(x^2+10)-25x-62=4x^3+15x-62=(x-2)(4x^2+8x-31)$

$\therefore \underline{x-2}$ is the G. C. M. Ans.

3. Solve the equation:—

$$\frac{2x-6}{3x-8}=\frac{2x-5}{3x-7}$$

Clearing of fractions $6x^2-32x+42=6x^2-31x+40$

collecting $x=\underline{2}$. Ans.

FOURTH YEAR.

Pupil Teachers at end of Fourth Year, *if apprenticed on, or after,* **1st May, 1878; and Pupil Teachers at end of Fifth Year,** *if apprenticed before that date.*

Three hours and a half allowed for this paper.

Arithmetic.

MALES.

1. A man invests £4875 in the 3 per cents. at 97½; he afterwards sells out at 99, and reinvests the money in railway shares at 110 paying a dividend of 4 per cent. Find the increase in his income.

(*a*) £97½ : £4875 :: £3 : 1st income.

$$\frac{£3\times 4875\times 2}{195}=£150$$

(*b*) £97½ : £4875 :: £99 : Money received by selling stock.

$$\frac{£99\times 4875\times 2}{185}=£4950$$

(*c*) £110 : £4950 :: £4 : 2nd income.

$$\frac{£4\times 4950}{110}=£180$$

Increase in income = £180 − £150, or $\underline{£30}$. Ans.

2. Find the present value of a bill for £2287 10s. due 5 months hence, interest being at 4 per cent. per annum.

Interest on £100 for 5 mos. at 4 p. c. = £1⅓.

Amount of " " " = 101⅓.

£101⅓ : £100 :: £2287 10s. : pres. val.

$$\frac{£2287\frac{1}{2}\times 300}{305}=\frac{£1372500}{610}=\underline{£2250}.\ \text{Ans.}$$

3. First find the value of ·2142857 of 3 guineas + 1·375 of £2 − ·0625 of a crown + 4·16 of 1d.; and reduce the result to the decimal of £5.

(*a*)

·2142857	of 3 guin.	= 13·5s.	= 162
1·375	of 40s.	= 55s.	= 660
4·16d.	of 1d.	=	4⅛
		Total	= 826⅛
deduct ·0625	of 60d.		= 3¾
		Result	= 822 5/8

(*b*) $\frac{822\frac{5}{8}\text{d.}}{£5} = \frac{822\frac{5}{8}\text{d.}}{1200\text{d.}} = \frac{6585}{9600} = \underline{\cdot 6853472}$. Ans.

4. The capital of a railway company is £5,000,000; the gross earnings in a year are £500,000, and the expenses are 55 per cent. of the earnings. What dividend per cent. can the company pay on the capital?

$\frac{45}{100}$ of £500,000 = £225,000 sum to be divided.

£5,000,000 : 100 :: £225,000 : dividend per cent.

$\frac{£225000 \times 100}{5{,}000{,}000} = \underline{4\frac{1}{2} \text{ per cent.}}$ Ans.

5. A man mixes 36 gals. of whiskey at 15s. a gal., with 36 gals. at 13s. 6d. a gal., and adds 9 gals. of water. If he sells the mixture at the rate of 19s. a gallon, what per cent. does he gain on his outlay?

	s.
36 galls. at 15s.	= 540
36 ,, ,, 13½s.	= 486
9 ,, water	
81 galls. cost	1026
81 ,, sold at 19s. each	= 1539
gain	= 513

∴ 1026 : 513 :: 100 : gain per cent.

$\frac{100 \times 513}{1026} = \underline{50}$. Ans.

FEMALES.

1. Find the amount of £417 7s. 9d. for 1 year 10 months at 4½ per cent.

$$\text{Interest} = £417\ 7\text{s. } 9\text{d.} \times \tfrac{22}{12} \times \frac{4\frac{1}{2}}{100}$$

$$= 417{\cdot}3875 \times \tfrac{77}{800}$$

77

29217125

29217125

80)321 38·8375

12)401·73546875

£33·47795572916

20

9·559114583s.

12

6·709375d. = 6 11/32.

∴ Amount = £417 7s. 9d. + £33 9s. 6 11/32d.

= £450 17s. 3 11/32d. Ans.

2. If tea be bought at 3s. 6d. per lb., and be sold at 3s. 10½d. per lb., find the gain per cent.

42d. : 100d. :: 4½d. : gain per cent.

$\frac{4\frac{1}{2}\text{d.} \times 100}{42} = \underline{10\frac{5}{7} \text{ p. c.}}$ Ans.

3. A hare pursued by a greyhound was 130 yards before him at starting; whilst the hare ran 5 yards, the dog ran 7 yards; how far had the hare gone when she was caught by the dog?

The dog gains 2 yards every time the hare goes 5 yards, how far will the hare go before the dog gains 130 yards?

2 yds. : 130 yds. :: 5 yds. : distance required.

$\frac{5 \text{ yds} \times 130}{2} = \underline{325 \text{ yds.}}$ Ans.

4. If 20 men can do a piece of work in 12 days, find the number of men who could do another piece of work 3 times as great in ⅕th of the time.

$\left.\begin{matrix} 1 : 5 \\ 1 : 3 \end{matrix}\right\}$ :: 20 : men required.

20 men × 5 × 3 = 300 men. Ans.

Grammar.

1. '*How* many men, in the common concerns of life, lend sums of money which they are not *able* to spare, *are bound* for persons whom they have little friendship *for*, give recommendatory characters of men *whom* they are not acquainted with, bestow places on those whom they do not esteem, *live* in such a manner as *themselves* do not approve, and *all this* merely because they have not the confidence to resist solicitation, importunity, or example!' ADDISON. *Essay on False Modesty.*

(*a*) Show from the above that an infinitive may be the complement of a verb.

(*b*) Analyse from *How many men* to *spare*.

(*c*) Parse the words in italics.

(*d*) To what period of the English language does the above belong? Notice any difference you may observe in it, compared with the style of the present day.

(*a*) The infinitive 'to spare' is the complement of 'are not able.'

The infinitive '(to) esteem' is the complement of 'do.'

,, 'approve' ,, 'do not.'

(*b*) (1) 'How many men, in the common concerns of life, lend sums of money.' (Principal sent.)

(2) 'Which they are not able to spare.' Subord. adj. sent. qual. 'sums of money.'

ANALYSIS.

	1.	2.
Simple subject	'*men*'	'*they*'
Enlargement of subject	'*how many*'	
Predicate	'lend'	'*are not able to spare*'
Object	'*sums*'	'*which*' (obj. of 'to spare')
Enlargt. of object	'*of money*'	
Extension of predicate	'*in the common concerns of life*.'	

(*c*) *How*—adv. of degree mod. 'many.'

able—predic. adj. qual. 'they.'

are—bound—irreg. trans. verb, *bind*, *bound*, *bound*, pass. voice, indic., pres., indef. 3rd pers. plur., agr. with subj. 'men.'

for—prep. (used after its case), gov. obj. case 'whom.'

whom—simple rel. pron. referring to 'men,' 3rd pers. plur., mas., obj. gov. by 'with,' which follows its case.

live—reg. intrans. verb, indic., pres., indef., 3rd pers. plur. agr. with ('men').

themselves—(= they) compound pers. pron., 3rd pers. plur., mas., nom., subj. of 'do.'

all—indef. adj. pron. qual. 'this.'

this—demonstr. adj. pron., sing., neut., nom. to such a verb as 'is done,' understood.

(*d*) The passage belongs to the period of Modern English of the age of Queen Anne.

The following differences may be noted: the preposition is used after the relative 'whom;' 'recommendatory' is not usual now; 'themselves' cannot be properly used without 'they;' instead of using 'men' to play the part of subject to so many verbs it is customary now-a-days to break up such a passage into two or three sentences.

2. Give the meaning of the following words:—*Ethics*, *astronomy*, *eucharist*, *monastery*. State to which element in our language they belong and account for their introduction into our language.

Ethics means 'a system of morality.'
Astronomy ,, 'the science of the stars.'
Eucharist ,, 'the Lord's supper' (a thanksgiving).
Monastery ,, 'a house for monks, convent.'

These words belong to the Greek element of our language; 'eucharist' and 'monastery' came to us in Latin forms during what has been called the Latin of the second period, that is, the Latin brought through intercourse with the Church of Rome, between the coming over of St. Augustine and the Norman Conquest.

'Ethics' and 'Astronomy' were introduced after the revival of learning to supply the need for expressive terms in science and philosophy.

Geography.

1. Give full notes of a lesson on the Gulf of Mexico, and illustrate by a map. Insert the lines of latitude and longitude.

POSITION AND BOUNDARIES.—A large mediterranean sea of North America, communicating by the Florida Channel with the Atlantic, and by the Channel of Yucatan with the Caribbean Sea, and on the other sides enclosed by the United States, Mexico, and Yucatan. The eastern side is bounded by the Antilles.

EXTENT AND CHARACTER.—Extends from east to west, over 1,000 miles, and its greatest breadth is nearly as much. Its shores are low in general, and skirted with flat, sandy islands. Its waters are distinguished by their high temperature, being generally eight or ten degrees above that of the neighbouring ocean.

GULF STREAM.—The distinguishing feature of the Gulf of Mexico is the Gulf Stream, so called from passing through this Gulf. This stream is the local name of a section of the equatorial current of the Atlantic, which current passes through the Windward Islands, across the Caribbean Sea, into the Gulf, which, with only two outlets and hemmed in by mountains, is exposed to the full heat of a tropical sun. As the stream sweeps round the Gulf it becomes very hot, and is swollen by the waters of the Mississippi, till at length it forces its way out into the Atlantic between Florida and Cuba in a stream of from thirty to forty miles wide and 600 or 700 ft. deep, and at a speed of about eighty miles a day.

RIVERS AND TOWNS OF THE MEXICAN GULF.—Mississippi, Colorado, Rio Grande del Norte, Santander, Tabasco, Galveston, Mobile, New Orleans, are the chief ports.

2. What is a river-basin? Illustrate your answer by reference to the basin of the Amazon.

The basin is the whole area or space of ground which supplies the water to a river. It comprises not only the valley of the main river itself, but those of all the rivers and streams which run into it, with all their tributaries up to the water-parting of each.

The Amazon is formed by the junction of the Maranon and Ucayali. The Maranon rises in a small lake on the plateau of Pasco, and the Ucayali is its head-stream, rising in the table-land of Cuzco. From the junction of these two streams the Amazon flows easterly for 3,000 miles, before reaching the Atlantic, into which it empties itself by a large estuary which contains numerous islands, and is 180 miles wide at its mouth.

More than twenty feeders of this mighty river are at least 1,000 miles in length, and these flow mainly from the south. Among them may be noted the Purus, Madeira, Tapajos, Xingu, Tocantins. The Madeira is the largest tributary, and exceeds 2,000 miles in length.

Among the northern tributaries are the Napo, Japura, and Rio Negro; the last being 1,400 miles long.

The basin of the Amazon embraces an area of two and a-half million square miles, and is bounded by the Andes in the west, the mountains of Guiana in the north, and the mountains and high-lands of Brazil in the south.

SECOND PAPER.

History.

Two hours and a half allowed.

1. What periods of our history have been remarkable for contests with France? To what in general would you attribute those contests?

The periods most remarkable for contests with France were during the reigns of Edward III. and Henry V. The former laid claim to the French crown by right of his mother, and to support his claim the battles of Crecy (1346) and Poictiers (1356) were fought. The latter claimed the fulfilment of the Treaty of Bretigny, which had been concluded with Edward III. This being refused, Henry V. invaded France, and by the battle of Agincourt (1415) completely routed the French. Five years after was framed the Treaty of Troyes, by which it was agreed that Henry should become King of France on the death of Charles.

Hence we conclude that the general cause of these wars was the desire of the British kings to get possession of the French crown. The title 'King of France' was till lately claimed by our monarchs.

2. What was the condition of Parliament during September, 1882? What is its condition now, and what do you expect to be the next change?

In September, 1882, Parliament was *adjourned*, in the end of October it was *in Session*, and the change expected was its *prorogation*.

3. Give dates and brief particulars of any wars in which this country has been engaged during the present reign in Europe, Asia, and Africa.

In 1840 England took the part of the Sultan of Turkey against the Pasha of Egypt, and Acre was bombarded by Stopford and Napier.

In 1840 a war arose with China about the opium trade, and Hong-Kong was ceded to Britain. In 1856, and again in 1860, fresh quarrels arose, and the English and French entered Pekin.

In 1838 a war begun in Afghanistan is memorable for the disasters which befell the British troops in occupation of Cabul. Being forced to retreat by a rising of the natives, they were cut off almost to a man, one officer alone escaping to Jellalabad.

In 1843 Sir Charles Napier conquered Sind.

In 1845 and again in 1848, wars with the Sikhs of the Punjaub ended by the victory of Goojerat, 1849.

In 1850 British Kaffraria was conquered from the Kaffirs.

In 1867 Sir Robert Napier conducted the Abyssinian Expedition against King Theodore to rescue certain British subjects and other Europeans.

In 1873 Sir Garnet Wolseley chastised the Ashantees.

In 1879 Zululand was conquered by the British.

In 1881 the Boers, who had risen in the end of 1880, were granted self-government under the suzerainty of the British.

In 1882 the Egyptians, under Arabi, rebelled against the Khedive. The rebels were scattered by Sir G. Wolseley at Tel-el-Kebir.

The only war in Europe during the reign was the Crimean war, in 1854-55, undertaken in conjunction with the French to assist the Turks against Russia. During the war occurred the battles of the Alma, Inkerman, and Balaclava. It was ended by the taking of Sebastopol, 1855.

In 1857 occurred the outbreak of the Indian Mutiny, which was completely stamped out by the taking of Lucknow, in the beginning of 1858.

By the murder of the British resident at Cabool, General Roberts made a triumphant march, punished the Afghans, and occupied the city. However, he was eventually ordered by the Government at home to withdraw, 1879.

Penmanship.

Write, in large hand, as a specimen of copy-setting, the word *Cymbeline*.

Write, in small hand, as a specimen of copy-setting, *The Turkish preparation makes for Rhodes.*

Composition.

Write a short essay on *Fables and their uses.* (Illustrate the subject by giving any fable you can remember.)

FABLES AND THEIR USES.

In a general sense fables mean fictitious narratives, but they also mean more particularly a species of composition, consisting of short fictitious tales, written for the purpose of teaching some moral truth or precept. The fable is sometimes divided into two kinds, the *fable proper* and *the parable*. The parable narrates some incident which, although it may not have happened exactly as the narrator supposes, yet could have happened, there being nothing impossible or improbable in it. The fable proper, on the other hand, relates facts which are evidently untrue, and could not have happened; such as animals or even inanimate things speaking, but which serve as comparisons for the actions of men. The fable embodies a moral in a special case; this is invested with reality, and narrated as a story, which suggests the moral at once. Thus the well-known story of 'The Man and the Bundle of Sticks' embodies a moral truth, namely, the power of union.

Many of the fables proper, or Apologues as they are called, turn upon the actions and characteristics of animals. This practice has evidently risen out of the circumstance that the animals chosen have a certain fixed character; as the cunning of the fox, the strength of the lion, the meekness of the lamb.

When a fable is lengthened into details, so as to form long and sustained comparison, it is called an Allegory.

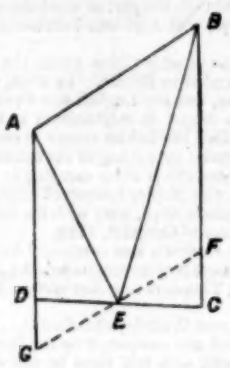
Euclid.

MALES.

[All generally understood abbreviations for *words* may be used.]

1. A B C D is a trapezoid, B C being parallel to A D. If E be the middle point of D C, the triangle A E B is half the trapezoid.

Through E draw G E F parallel to A B, and produce to meet the parallel sides of the trapezoid in F and G.



Then (I. 26) the triangles D E G, E F C are equal, and thus the trapezoid is equal to the parallelogam A G F B.

Now (I. 41) the triangle A E B is half of the parallelogram A G F B, and therefore equal to half the trapezoid. Q. E. D.

2. To draw a straight line through a given point parallel to a given straight line.

Prop. 31, Bk. I.

3. If a straight line be divided into any two parts, the square on the whole line is equal to the squares on the two parts, together with twice the rectangle contained by the parts.

Prop. 4, Bk. II.

Algebra.

1. Find the value of $\frac{b}{a+b}+\frac{b}{a-b}-\frac{b^2}{a^2-b^2}$ when $4b=3a$.

L. C. M. of denrs. $=a^2-b^2$

$$\therefore \frac{ab-b^2+ab+b^2-b^2}{a^2-b^2}$$

$$=\frac{2ab-b^2}{a^2-b^2}$$

Substituting $\frac{3}{4}a$ for $b=\left(2a\times\frac{3a}{4}-\frac{9a^2}{16}\right)\div\left(a^2-\frac{9a^2}{16}\right)$

$$=\left(\frac{3a^2}{2}\text{ or }\frac{24a^2}{16}-\frac{9a^2}{16}\right)\div\left(\frac{16a^2-9a^2}{16}\right)$$

$$=\frac{15a^2}{16}\times\frac{16}{7a^2}=2\tfrac{1}{7}.\quad\text{Ans.}$$

2. Solve the equations :—

(1) $\frac{3x}{4}-\frac{2y}{3}=1=\frac{7x}{18}+\frac{5y}{36}$

(2) $\frac{68x}{7}-\frac{7}{x}=8x+11$

(1) Clearing of fractions $9x-8y=12$ or $45x-40y=60$

$14x+5y=36$ or $112x+40y=288$

By adding $157x=348$

$x=2\frac{154}{157}$.

$y=1\frac{149}{157}$.

(2) Clearing of fractions $68x^2-49=56x^2+77x$

Transposing and collecting $12x^2-77x-49=0$

Factorizing $(12x+7x)(x-7)=0$

Hence $x=7$

Or $x=-\frac{7}{12}$. Ans.

3. Find two consecutive numbers, such that the half and the fifth of the first taken together shall be equal to the third and the fourth of the second.

Let x = the one, then $x+1$ = the other

$$\therefore \frac{x}{2}+\frac{x}{5}=\frac{x+1}{3}+\frac{x+1}{4}$$

clearing of fractions $30x+12x=20x+20+15x+15$

transposing $42x-35x=35$

$7x=35$

$x=5$ first No. Ans.

and 6 second No. Ans.

Mensuration.

MALES.

Find the side of an isosceles right-angled triangle whose area is the same as that of the triangle with sides 10, 11, 12.

$$\text{Half sum of sides}=\frac{10+11+12}{2}=16{\cdot}5$$

$$\therefore \text{Area of triangle}=\sqrt{16{\cdot}5\times6{\cdot}5\times5{\cdot}5\times4{\cdot}5}$$

$$=\sqrt{2654{\cdot}4375}$$

$$=51{\cdot}52.$$

Now in an isosceles right-angled triangle the base = perpendicular; and as the area of such a triangle will equal *half the square of base or perpendicular*,

$$\therefore \frac{\text{Base}^2}{2}=\text{area}=51{\cdot}52$$

$$\text{Base}^2=103{\cdot}04$$

$$\text{Base}=\sqrt{103{\cdot}04}$$

$$=10{\cdot}15.\quad\text{Ans.}$$

—o—

[*All changes in this Syllabus for the year* 1883 *are printed in italics.*]

Syllabus for Male Candidates.

DECEMBER, 1883.

Education Department.

The Examination for Certificates will commence on Monday, the 10th of December, 1883, at 3 p.m.

N.B.—Acting Teachers attending the examination may, at their option, take the papers of the first or second Year, *subject to the provisions of the following Articles of the Code of 1882:—*

Article 66.—Candidates who at the examination of December, 1883, or any subsequent examination, shall pass successfully in the subjects for the first years' students will receive certificates of the third class.

Article 67.—Certificates of the third class do not entitle their holders to have the superintendence of pupil-teachers.

Article 68.—Certificates of the third class can be raised to a higher class only by a subsequent examination in the subjects for second years' students. A teacher cannot be re-examined for this purpose more than once in every two years.

Reading* and Repetition from Memory.

First Year.

To read with a distinct utterance, due attention to the punctuation, and just expression. Each Student must have learned at least 300 lines of poetry from the work selected under Grammar (section 2), and will be called upon to repeat some part at the Annual Inspection of the Training College.

Second Year.

Candidates will be expected to show improvement in the higher qualities of Reading, such as expression, modulation of voice, and the correct delivery of long or involved sentences. Each Student must have learned at least 300 lines of poetry or 200 lines of prose from one of the works named under Grammar, and will be called upon to repeat some part at the Annual Inspection of the Training College.

Penmanship.

First Year.

1. To write a specimen of the penmanship used in setting copies of text hand and small hand.
2. To write a passage from Dictation.
3. The general character of the writing in the Examination Papers will be considered in deciding upon the proficiency of Candidates in the subject.

* The Students of the *first* year will be expected to read a passage from Goldsmith's *Traveller*, Milton's *Comus*, or Lamb's *Tales from Shakespeare*; the Students of the *second* year from Shakespeare's *Macbeth* and *Tempest*, *or* from a newspaper. These authors must not be studied in class, but must be left to the private reading of the Students.

Second Year.

As in First Year, but defects more severely visited with loss of marks.

NOTE.—Writing, as taught in schools, is apt to be too small and indistinct. Pupils should be taught to write a firm, round, legible hand.

School Management *

First Year.

1. The methods and principles of elementary teaching, generally, and with special reference to the development of the intelligence of children.
2. Notes of Lessons.
3. The form of school registers, the mode of keeping them, and of making returns from them.

Second Year. †

1. To teach a class in the presence of Her Majesty's Inspector.
2. To answer questions on the following subjects:—
   (*a.*) The different methods of organizing an elementary school.
   (*b.*) The form of school registers, the mode of keeping them, and of making returns from them.
   (*c.*) The ventilation and drainage of School Premises.
3. The training of the senses and of the memory; the processes of reasoning; the order in which the faculties of children are developed; the formation of habits and of character;—all considered in their application to the methods of teaching and of moral discipline.

Grammar and Composition.

First Year.

1. The elements of Grammar.
2. To parse words selected from passages in Byron's *Childe Harold's Pilgrimage, Canto III., stanzas 1—60.*
3. To analyse passages from the Book selected.
4. To write plain prose upon a given subject.
5. An explanation of the meaning and words in the selected passages.

Second Year.

1. To paraphrase passages from Shakespeare's *Julius Cæsar* and Bacon's *Essays* (*38-58*).
2. To answer questions on the language, style, and subject-matter of the work chosen for paraphrase.
3. To write plain prose upon a given subject.

Geography.

First Year.

1. The elements of Geography, Mathematical and Physical.
2. To describe in words, and draw the map of, the four quarters of the globe, of each country in Europe (that of Great Britain in fuller detail), and of Hindostan, Australia, New Zealand, Canada, and the South African colonies.
3. The Political Geography of the British Empire.

Second Year.

1. The Geography, Physical, Political, and Commercial, of the British Empire.
2. Map drawing, confined within these limits.

History.

(The Papers will contain questions on the history of Scotland.)

First Year.

General outlines of British History.

Second Year.

A special period in greater detail. From the year *1760* to the accession of Queen Victoria.

Arithmetic, Algebra, and Mensuration.

First Year.

1. To work Arithmetical sums, both mentally and on paper.
2. To prove and explain the rules.

The figures should be well formed and the work methodically arranged as a good model for children to imitate.

3. To answer simple * questions, both theoretical and practical, in Algebra, and the Mensuration of plane surfaces.

Second Year.

More difficult questions,* and problems, in Algebra, and Mensuration.

Geometry.

First Year.

The first two books of Euclid, with simple deductions from the propositions *and easy geometrical problems.*

Second Year.

The first four books of Euclid, and the first fifteen propositions of the Sixth Book, with simple deductions from the propositions *and easy geometrical problems.*

Economy.

Second Year.

Elementary Questions in Political Economy. Works on this subject, published of late years for use in schools, contain matter to which these questions will have reference.

Vocal Music.

First Year.

1. Notation: the treble and bass staves, and the relation between them.
2. Time: Simple common, and simple triple.
3. The scales, major and minor; with the intervals (major and minor, perfect or other) found in both, and the chromatic intervals found in the latter.
4. Transposition from one key to another; and transcription from one variety of time to another (as from $\frac{4}{4}$ to $\frac{4}{2}$).

Second Year.

1. Notation: The alto and tenor staves, and their relations to the treble and bass.
2. Time: compound common and compound triple.
3. Classification of intervals, as perfect and imperfect, consonant and dissonant.
4. Resolution of individual dissonant intervals.
5. Rudiments of harmony: Positions of chords; progression; inversion; discords by suspension (on fundamental basses only); the discord of the dominant seventh (in its direct form only).

NOTE.—A paper on this subject is not given to any Student, about to leave the Training College, how has not passed the Musical Inspector's examination in practical skill. Acting teachers who take this paper must produce a certificate from some competent person (such as the organist of their church) that they have 'such an amount of musical skill, vocal or instrumental, as is sufficient for the purpose of teaching children to sing from notes.'

Drawing.

[*N.B.*—This exercise does not form part of the December examination. Annual examinations, in drawing only, are held at each of the Training Colleges under inspection some time in November, and at the various local drawing schools in connection with the Department of Science and Art, at times to be learned from the masters of those schools. The value of the exercises is marked, and the marks carried to each candidate's total, for a certificate under this Syllabus.]

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* Passages taken from Reading Lesson Books commonly used in schools may be given in the papers on all subjects which admit of it, and candidates will be expected to show how they would explain such passages to children. Each paper may also contain questions on the method of teaching the elementary parts of the subject to which it relates.

† No Student will be examined, unless the Principal certifies that he has spent at least six weeks, or 150 hours, in the Practising and Model Schools, under proper superintendence, during his residence, and at least half that time during his second year.

* In Algebra, the Students of the first year should understand the four simple rules, involution, evolution, common measures, common multiples, algebraic fractions and surds, ratios and proportions, progressions and the solution of simple and easy quadratic equations, of one or more unknown quantities, or problems producing such. Those of the second year should, at least, add to this a knowledge of permutations and combinations, the Binomial Theorem, logarithms, interest and annuities, scales of notation, and the solution of more difficult equations or problems producing such.

In Mensuration, the Students of the first year should understand the measurement of every species of plane rectilineal figure, *and of the circle.* Those of the second year should add to this a knowledge of the measurement of cylinders, spheres, cones, and a few irregular solids.

Students of the first year who do not obtain at least 60 per cent. of the total number of marks obtainable in Algebra and Mensuration will be required to take up the same portions of those subjects in their second year.

The series of exercises prescribed in the Art Directory* of the Department of Science and Art for a Drawing Certificate of the Second Grade.

Special Subjects.

Additional marks will be given to a Candidate for success in some of the following subjects, provided that he passes for a Certificate, according to this Syllabus, without counting marks for these special subjects.

I. Languages.

1. Latin.
2. Greek.
3. French.
4. German.

Candidates may take one or two (but not more) of these languages. Students will be examined in those languages only for which a special course of instruction is provided in the Time Table of their College.

First Year.

This paper will contain grammatical questions, and easy passages † in prose for translation from and into English.

Second Year.

This paper will contain harder passages † (in poetry as well as prose) for translation from and into English prose, with questions upon the construction of particular sentences.

II. Science.

See Extracts from Minute of 17th January, 1878.
At Whitehall, the 17th day of January, 1878.

BY THE RIGHT HONOURABLE THE LORDS OF THE COMMITTEE OF HER MAJESTY'S MOST HONOURABLE PRIVY COUNCIL ON EDUCATION.

1. The Lords of the Committee of Council on Education consider the subject of Science Instruction in Training Colleges. They believe that the time has arrived when a special examination should be instituted at a period of the year better adapted to the Training Colleges than May; and that the nature of the examination and the payments made on the results should be modified to suit the circumstances of those Colleges.

2. They therefore determine that in future a special examination in Science shall be held in Training Colleges in December, immediately before the ordinary Christmas Examination.

3. The examination will not be open to Acting Teachers. It will be held in those subjects only for which a special course of instruction is provided in the time table of the College, and will be conducted by one of Her Majesty's Inspectors, or by an officer of the Science and Art Department.

4. No Student in a Training College will be allowed to attend the May examinations of the Science and Art Department.

5. The examination will be confined to the following ten subjects:—

1. Mathematics.
2. Theoretical Mechanics.
3. Applied Mechanics.
4. Acoustics, Light, and Heat.
5. Magnetism and Electricity.
6. Inorganic Chemistry, including Practical Chemistry.
7. Animal Physiology.
8. Elementary Botany.
9. Physiography.
10. Principles of Agriculture.

6. No Student will be permitted to take up more than two subjects in any one year. Women will not be permitted to take more than one subject in a year.

7. The examination, except for Mathematics, will be based on the syllabus of the several subjects given in the Science Directory. But the two stages, Elementary and Advanced, will be treated as a whole—one paper only being set. These examination papers will be framed much as the present May papers are framed, that is to say, with a certain number of compulsory questions and a certain number of optional questions, some of the latter being more difficult, and more highly marked, than the rest. Questions will also be set on the method of teaching various branches of the subject. The syllabus for the Mathematical examination is given in the Appendix.

8. The successful Students will be placed in the 1st or 2nd Class, the standard for a 2nd Class being as high as that of a good 2nd Class in the present Advanced Stage, and for the 1st Class of a good 1st Class in the Advanced Stage.

9. All Students who pass will be registered as qualified to earn payments on results and will receive certificates, but no prizes will be given.

APPENDIX.

SYLLABUS FOR MATHEMATICS IN TRAINING COLLEGES.

Geometry—
All the propositions of plane geometry; including the doctrine of proportion, so far as it is treated in the definitions of the fifth and in the sixth book of Euclid.

Algebra—
Up to indeterminate coefficients and continued fractions.

Logarithms—

Trigonometry—
So far as it is required for the measurement of triangles, areas, heights, and distances.

Solid Geometry—
First principles, including the volume and surface of the right cylinder, cone, and sphere.

A Student who passes in this subject will be registered as qualified to earn payments on results in Stages 1, 2, 3, and 4 of Mathematics.

N.B.—1. *A Student may not, in his first year, take up more than two special subjects, nor, in his second year, more than four.*

2. A Student, who, at the end of his first year, passes with credit in History, or Geography, or both, may in his second year omit such subject, or subjects.

3. A Student who fails to pass with credit in either, (or both,) of these two subjects, must take it, (or them,) up again in his second year, and may not, in that year, take up more than three (or two) special subjects.

4. *A Student will be required to present himself at the end of his second year for examination in any science in which he may have failed to obtain at least a second class at the end of his first year; such subject or subjects will be considered as the first of the optional science subjects to which he may be entitled by the foregoing rules.*

5. Acting Teachers, who attend the Christmas Examination, will receive additional marks for any two of the specified Science Subjects, in which they may have obtained a first or second class in the Advanced Stage or in honours, at one of the May Examinations held by the Science and Art Department.

Correspondence.

St. Paul's Board Schools,
Hounslow Heath,
4th November, 1882.

DEAR SIR,—Will you please kindly allow me a small space in your excellent PRACTICAL TEACHER to ask any of our able correspondents if they will please give information on the following?—In the 'Grammatical Questions' for PRACTICAL TEACHER last July, three of the exercises were taken from Tennyson, and two were taken from the same author for last November, and it may be noticed that these exercises have often been selected from this author.

I should be glad to learn from which of Mr. Tennyson's works they are taken, and is there such a thing as a very cheap edition of this work or these works issued? Perhaps some able correspondent who is familiar with this author will kindly inform me.

I am, dear sir,
Yours faithfully,
E. MARTIN.

ERRATA.—Scholarship Examination, last month's issue:—
For 4 read $4x$ in divisor, lines 2 and 3. Ex. 8. Algebra. (Simplify, etc.)
For $16\frac{1}{2}$ read $17\frac{1}{2}$. Ex. 9. Arithmetic.

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* For information respecting the examinations in Science and Art, and for copies of the Science and Art Directories, application may be made to 'The Secretary, Science and Art Department, South Kensington, London, W.'

† In 1883 the passages will be taken from *Cæsar de Bello Gallico*, Book III., Virgil's *Æneid*, Book VI., Xenophon's *Anabasis*, Book III., Euripides' *Medea*, Bonnechose's *Lazare Hoche*, Racine's *Iphigenie*, Goethe's *Italian Journey*, and Schiller's *Maria Stuart*. In 1884 the passages will be taken from *Cæsar de Bello Gallico*, Book II., Virgil's *Æneid*, Book II., Xenophon's *Anabasis*, Book II., Euripides' *Alcestis*, Saintine's *Picciola*, Book II., Racine's *Iphigenie*, Goethe's *Italian Journey*, and Schiller's *Maria Stuart*.

KEEP PEGGING AWAY.

Music by T. A. WOOD.

♩=184.
1st TREBLE.
2nd TREBLE.
BASS.
1. Tho' our task may be hard, boys, and wea - ry, and long, We may light - en our bur - den by
2. There is much to be done, boys, and do it we must; So we'll nerve for the bat - tle with
3. Our fore - fa-thers proved this an ex - cel - lent plan, They "went in" to con-quer what -
4. That ex - am - ples like these be not set us in vain, Let us walk in their foot-steps, and
KEY F.
1st TREBLE.
2nd TREBLE.
BASS.
mu - sic and song; But the goal *must* be reached tho' we toil night and day, So our mot - to shall
hearts full of trust; And we'll *prove* we've the will, and can show there's a way, By being true to our
- e'er they be - gan; Brave Nel - son, and Gar - field, and Lin - coln, they say, Reached the ac - me of
work in their train; Then, as day fol - lows night, and as night fol - lows day, *We* shall glo - rious - ly
rall
rall.
Tempo.
be, boys,—Keep peg - ging a - way!
watchword—Keep peg - ging a - way!
glo - ry by peg - ging a - way!
tri - umph by peg - ging a - way!
Keep peg - ging a - way! keep peg - ging a - way! So our
Tempo.
mot - to shall be, boys, Keep peg - ging a - way!
Symph.
Symph.

ANSWERS TO ARITHMETICAL QUESTIONS IN 'THE SCHOLAR,' FOR JANUARY, 1883.

STANDARD IV.

A. 1. £34,290 15s. 6½d.
2. £16 5s. 4½d—2.
3. 1,344,000 ozs.
B. 1. £48,271 1s. 11¾d.
2. £45 19s. 6½d.—81.
3. 21 ton 5c. 1q. 6lb. 9oz.
C. 1. 839,601 sq. in.
2. £7 7s.
3. £6 12s. 4⅓—3653.
D. 1. £177,136 9s. 10½d.
2. 139,392 sq. yards.
3. £23 10s. 1½d.—367.
E. 1. 175 coats—2 yards 3 inch left.
2. £1,011 10s.
3. 31,536,000 sec.
F. 1. 60 days
2. 1,416yd. 2q. 2nl. 1½in.
3. 12 w. 3 d. 23 h. 59 m. 43 s.

ADVANCED EXAMINATION.

1. £66 16s. 10½d. gain.
2. £414.
3. 57 cows.

STANDARD V.

A. 1. £107 13s. 11½d.
2. £291 7s. 11⅛d.
3. 196.
B. 1. 5s. 11½d.
2. £2,605 15s. 7½d.
3. £25 14s. 0⅜d.
C. 1. £68 18s. 6¾d.
2. £62,884 11s. 7⅜d.
3. £92 18s. 6¾d.
D. 1. £611 2s. 4½d.
2. £41 11s. 11d.
3. £2,514 16s. 9d.
E. 1. £145,192 15s. 7⅞d.
2. £7 4s. 10$\frac{33}{113}$d.
3. 459.
F. 1. £40 7s. 4d.
2. 256½ miles.
3. £11 2s. 6$\frac{1}{16}$d.

ADVANCED EXAMINATION.

1. £13 10s. m., £4 10s. w., £1 10s. b.
2. £54 10s. 11d.
3. 10 to 9.

STANDARD VI.

A. 1. $\frac{1}{56}$.
2. ·15390625.
3. £25 8s. 11½d.
B. 1. £2 13s. 3·744d.
2. 28$\frac{1}{14}$$\frac{1}{4}$.
3. 50 days.
C. 1. $\frac{4}{11}$.
2. ·285.
3. 405 lb.
D. 1. £35 1s. 4$\frac{33}{113}$d.
2. ·0000021875.
3. £18 11s. 10½d.
E. 1. 1·499349+
2. $\frac{70}{333}$.
3. $\frac{333}{1000}$.
F. 1. ·000003.
2. m. £7 6s. 8d., w. £6 2s. 2½d.
3. £770 9s. 2·9352d.

ADVANCED EXAMINATION.

1. 9$\frac{1}{17}$ hours.
2. £9 8s. 10½d. gain
3. 1$\frac{8}{11}$$\frac{8}{11}$$\frac{8}{11}$ days.

STANDARD VII.

A. 1. £27 7s. 2¾d.
2. £89 17s. 7½d.
3. 3$\frac{3}{4}$ per cent.
B. 1. 3,607.
2. £8 0s. 1½d.
3. £3 8s. 10$\frac{1}{4}$$\frac{1}{4}$d.
C. 1. 5 $\frac{4}{17}$ years.
2. 4s. 8·241d.
3. 85$\frac{1}{17}$s.
D. 1. £101 5s.
2. £24 1s. 7·3725d.
3. 14s. 10$\frac{33}{113}$d.
E. 1. 5$\frac{1}{37}$ per cent. loss.
2. £649 2s. 5$\frac{1}{13}$d.
3. £24 2s. 3$\frac{3}{13}$d.
F. 1. 4$\frac{3}{11}$$\frac{3}{11}$ per cent.
2. £142 13s. 7·4856961d.
3. £93 16s. 10$\frac{3}{11}$$\frac{3}{11}$d.

ADVANCED EXAMINATION.

1. £3117 10s.
2. 5$\frac{1}{37}$ per cent; 2.759+
3. £8 1s. 10½d. decrease.

SOLUTIONS OF THE ADVANCED EXAMINATION QUESTIONS IN 'THE SCHOLAR,' FOR JANUARY, 1883.

STANDARD IV.

1. 3 ton 17 cwt. = 8624 lb., − 85 = 8539 lb. sold, which at 7½d. = £266 16s. 10½d. total selling price. Then £266 16s. 10½d. − £200 = £66 16s. 10½d. gain. Ans.

2. 1260 yds. = 20160 nls., and 2 yds. 2 qrs. 2 nls. = 42 nls.; then 20160 ÷ 42 = 480 lengths, which at 17s. 3d. each = £414 Ans.

3. 16 ton 14 cwt. 1 qr. 13 lb. = 37449 lb., and 15 lb. × 19 × 63 = 17955 lb. eaten by the horses. Then 37449 − 17955 = 69494 lb. eaten by the cows in 19 days, and 19494 lb. ÷ 19 = 1026 eaten in one day, and 1026 lb. ÷ 18 = 57 cows. Ans.

STANDARD V.

1. A man gets 9 times as much as a boy, hence the 60 men get as much as 540 boys, and the 80 women get as much as 240 boys; making a total of (540 + 240 + 100 =) 880 boys. Then £1320 ÷ 880 = £1 10s. a boy's share, £4 10s. a woman's, £13 10s. a man's share. Ans.

2.

		s. d.	£ s. d.
	25½ yards of silk at	7 6	= 9 11 3
	48½ ,, velvet ,,	8 6	= 20 12 3
	52 ,, cloth ,,	11 9	= 30 11 0
	6 doz. towels ,,	7½	= 2 3 6
	48 gross of buttons at 2½d. a doz.		= 6 0 0
			£68 18 0
£68 18s. = 1378s., at 2½d. each			= 14 7 1
			Ans. £54 10 11

3. 18 × 1½ = 27 women's day's work in 9 acres, and 1s. 6d. × 27 = 40s. 6d. cost of 9 acres = 4s. 6d. an acre done by women. It is easily seen from the question that a man does ½ an acre a day, and therefore the cost done by men is 5s. an acre. Hence the ratio is 5 to 4½ = 10 to 9. Ans.

STANDARD VI.

1. 2½ miles − 1⅜ (or $\frac{11}{8}$) miles = 1⅛ = $\frac{9}{8}$ miles. Then by proportion, $\frac{9 \text{ hr.} \times 20 \text{ m.} \times 10 \text{ d.} \times 9 \text{ length}}{18 \times 9 \times 11} = 9\frac{1}{11}$ hrs. Ans.

2. ·035 of £4670 = £163·45 cost of the cloth. ·475 of 300 yd. = 142·5 yd., and £·575 × 142·5. = £81·9375. 300 − 142·5 = 157·5 yds. the rem. ·55 guinea = £·5775. £·5775 × 157·5 = £90·95625. £81·9375 + £90·95625 = £172·89375 total selling price. £172·89375 − £163·45 = £9·44375 = £9 8s. 10½d. Ans.

3. $\frac{1}{72}$ + $\frac{1}{126}$ = $\frac{99}{1008}$ frac. of an ac. done by A and B in 1 hr. 3 ac. 1r. 15 p. = 3$\frac{1}{8}$ ac. = $\frac{197}{8}$ ac. Then ($\frac{197}{8}$ ÷ $\frac{99}{1008}$ ÷ 9) = ($\frac{197}{8}$ × $\frac{1008}{99}$ × $\frac{1}{9}$) = $\frac{11288}{891}$ = 12$\frac{2016}{8911}$ days. Ans.

STANDARD VII.

1. (£780 × 4½) ÷ 100 = £35·1
(£935 × 3½) ÷ 100 = £35·0625 } = £70·1625 interest on (£780 + £935 =) £1715. But the interest on £1715 at 5 p. ct. = £85·75, hence £85·75 − £70·1625 = £15·5875 short of 5 p. ct. on the £1715, to be made up by the extra ½ p. ct. on the amount at 5½ p. ct., £200 of which will make £1 additional interest. Then £15·5875 × 200 = £3117 10s. Ans.

2. 3½ − 3$\frac{1}{8}$ = $\frac{3}{8}$ million gallons increase, being on $\frac{25}{8}$ millions,—hence the increase is $\frac{3}{25}$ on the original quantity, and $\frac{3}{25}$ of 100 = 5$\frac{1}{25}$ per cent. increase in quantity. Ans. £905,400 − £880,420 = £24,980 decrease in value. Then $\frac{24980}{905400}$ of 100 = 2·759+ per cent. decrease in value. Ans.

3. £3½ × 37 = £129 10s. annual income from 3½ p. cts. £87½ × 37 = £3237½ cash received on selling out. £3237½ ÷ 80 = 40$\frac{7}{16}$ hundreds of 3 p. cts. bought. £3 × 40$\frac{7}{16}$ = 121$\frac{7}{16}$ = £121 8s. 1½d. Then £129 10s. − £121 8s. 1½d. = £8 1s. 10½d. decrease in income. Ans.

ANSWERS TO ALGEBRA QUESTIONS IN 'THE SCHOLAR,' FOR JANUARY, 1883.

EXERCISE XIII.

(1) 6. (2) $\frac{1}{4}(a+b+c+d)$. (3) 7. (4) -4. (5) 3. (6) -3. (7) -3. (8) $\frac{3}{5}$. (9) 6. (10) $\frac{1}{2}$. (11) 2. (12) $\frac{12}{m-n-p}$. (13) $\frac{11}{12}$. (14) $\frac{22}{a+b+16}$. (15) $\frac{38}{3-a}$. (16) $11\frac{11}{17}$. (17) 1. (18) $3\frac{11}{11}$.

ANSWERS TO ARITHMETICAL QUESTIONS IN 'THE LITTLE LEARNER,' FOR JANUARY, 1883.

STANDARD I.

A. (1) 22
(2) 51
(3) 206

B. (1) 107
(2) 185
(3) 258

C. (1) 317
(2) 892
(3) 2,573

D. (1) 890
(2) 1,634
(3) 2,582

E. (1) 54
(2) 521
(3) 507

F. (1) 25
(2) 27
(3) 8

G. (1) 273
(2) 745
(3) 266

H. (1) 99
(2) 34
(3) 4

I. (1) 9,071
(2) 12,447
(3) 28,584

J. (1) 2,907
(2) 1,324
(3) 779

STANDARD II.

A. (1) 71,013
(2) 69,502
(3) 349,864

B. (1) 5,516
(2) 73,957
(3) 1,235

C. (1) 61,236
(2) 539,400
(3) 1,085,007

D. (1) 1,965,180
(2) 4,825,620
(3) 10,195,200

E. (1) 2,216,592
(2) 2,936,466
(3) 4,025,230

F. (1) 47,289,242
(2) 20,030,320
(3) 64,345,491

G. (1) 21,805
(2) 18,061 + 2
(3) 9,087

H. (1) 9,334 + 6
(2) 4,769
(3) 8,199 + 10

I. (1) 6,497 + 51
(2) 68,384 feet
(3) 65 apples

J. (1) 4,658,986,920
(2) 178 marbles
(3) 48 oranges

K. (1) 7,089 + 32
(2) 1,160,496 pens
(3) 92 nuts

STANDARD III.

A. (1) 1,608
(2) 2,344 + 14
(3) 1,689

B. (1) 7,360
(2) 6,136 + 27
(3) 10,110 + 46

C. (1) 943 + 123
(2) 1,399 + 323
(3) 809

D. (1) 4,538 + 40
(2) 17,129 + 353
(3) 6,070

E. (1) £2 15s. 5½d.
(2) £3 14s. 7½d.
(3) £28 11s. 2¾d.

F. (1) £145 1s. 6d
(2) £2,142 2s. 0½d.
(3) £18,372 4s. 7¾d.

G. (1) 2s. 9½d.
(2) £3 17s. 5¾d.
(3) 13s. 10¾d.

H. (1) £142 15s. 9¾d.
(2) £527 9s. 6¾d.
(3) £17,198 16s. 10½d.

I. (1) 295,522 farthings
(2) 87 pairs of shoes
(3) 11d.

J. (1) £36 11s. 8d.
(2) 708 walnuts
(3) £1 1s. 6d.

K. (1) £2,122 19s. 0½d.
(2) £1 4s. 0½d.
(3) £70 4s. 9d.

Science Notes.

A NOVEL APPLICATION OF THE ELECTRIC LIGHT.—Among the most recent uses to which the electric light has been put, none more ingenious has been noticed than its introduction into dentistry. A well-known dentist has taken advantage of it to enable him to carry out his operations under more favourable conditions than the ordinary ones. He uses a small incandescent lamp to illuminate the cavity of the mouth of the patient. It is fitted into a vulcanite cup, which serves as a prop to keep the jaws apart.

* * * * *

ELECTRIC RAILWAYS.—Since these have been brought into partial adoption, the attention of many engineers has been devoted to improvements in the details of their working. Among new patents which are calculated to effect these, is one taken out by Edison, which is specially directed to prevent what has caused so much difficulty in working them, viz., tbe leakage of the current. Edison's new plan is to construct the ends of the rails and the fish-plates of nickel, and to have a copper strap between the rail and the fish-plate. Further, he proposes to have the rails japanned except on the top, and to cover the ties with an insulating compound. By these means he expects to reduce the leakage to a minimum.

* * * * *

THE new electric railway between the Giant's Causeway and Portrush was tried last month with fair success. Several experimental runs of over a mile each were made, with the result of attaining a speed of about ten miles per hour.

* * * * *

PRUSSIC ACID IN THE ANIMAL KINGDOM.—A curious myriapod has lately been observed in several hothouses in Holland, which appears to possess the remarkable property of producing prussic acid. On irritating the creature in any way it was noticed to give out a distinct smell of bitter almonds, and this was observed to be much more powerful if it were crushed. When some of these myriapods were killed and their bodies bruised with water, and this distilled, prussic acid was found in the distillate. Herr Egeling took the matter up, and made a series of investigations into it. His results lead him to the conclusion that the animal prepares or secretes a substance which under certain conditions is decomposed, giving prussic acid as one of the products of such decomposition. Various reagents he applied enabled him to ascertain the presence of such a substance, and probably another body which acts as a ferment, causing the production of the prussic acid, under certain conditions of excitement, in the living body. The myriapod is a foreign species of Fontaria.

POWER OF RESISTING POISONS IN INSECTS.—Some interesting experiments have been carried out lately by Mons. Fredericq, of Liege, on the large water-beetle (*Dytiscus*). He put several of these insects into aqueous solutions of urari (the Indian arrow-poison) and into solutions of strychnine of poisonous strength. A few drops of his solutions were sufficiently potent to kill a frog in a very few minutes. The beetles showed themselves in most cases quite unaffected by the poison; some experiments lasted for fourteen days, at the end of which they were apparently unharmed. Other beetles besides Dytiscus also showed themselves proof against the action, some maintaining themselves uninjured for nearly a month.

* * * * *

COAL IN THE UNITED STATES.—The coal supply of America has lately been attracting considerable attention, some rich seams having been discovered in the Southern States. It is not many years since the great fields of Pennsylvania were the only known deposits in the States; but recently large territories in Kentucky, Tennessee, Georgia, and Alabama have been found to be rich in the mineral. The extent of these territories is not less that 15,000 square miles, or four times that of the coal-field in Pennsylvania. Texas, also, is considered to be above a coal-field, which is thought to be of about 6,000 square miles extent. In both the coal is described as being exceedingly bituminous and of excellent quality. Some veins of good soft coal are being worked in the Indian territory, in Kansas and Missouri. The mines of the Osage Coal and Mining Co., which are situated at Macallis in this district, are among the best in the country. The coal turned out from them is described as being almost equal to the English Cannel, and as being free from impurities. It is already in very great demand over all the adjacent railways. The great Missouri basin, in which the deposits are found, is estimated to cover 84,000 square miles of territory. The Appalachian coal-field extends towards the south, becomes narrower as it crosses Kentucky, and widens again in Tennessee. Beyond this it expands across the north-west corner of Georgia, and enters Alabama, terminating in the vicinity of Tuscaloosa. It is estimated that in the State of Alabama alone enough coal will be yielded to supply the whole country for a century.

* * * * *

THE BRITISH ASSOCIATION.—It is announced that Mr. A. G. Vernon Harcourt, M.A., F.R.S., has been elected General Secretary of the British Association, in the room of the late Professor Balfour.

* * * * *

THE LATE PROFESSOR CHALLIS.—Astronomy at Cambridge has recently suffered a great loss in the death of the late Professor. He had lived and worked in the University for nearly a lifetime, and had done great things for the study of the science there. His own attainments as an undergraduate were remarkably brilliant, for he was Senior Wrangler and first Smith's prizeman of his year. He succeeded the late Astronomer-Royal, Sir G. Airey, as Professor.

* * * * *

A NEW FORM OF LOCOMOTION.—A great improvement in travelling by road is foreshadowed by a new invention of Messrs. Ayrton and Perry, in the shape of a tricycle, which is to be propelled by electricity. It is not a very great modification of the ordinary tricycle of recent days, the same shape being preserved, and the apparatus for the application of the motive power being comparatively inconspicuous, or, at any rate, not attracting more attention than a traveller's ordinary luggage. Close to the driving wheel of the tricycle, as we know it, is fixed a large wheel furnished with a number of teeth. A motor is slung from the seat platform, the armature spindle of which carries teeth which gear into those of the wheel. The battery is composed of a number of Faure cells, which are slung from the back-bone and axle. When fully charged these contain an amount of energy equal to two horse-power. The motor and battery together weigh not quite 150 lbs. The speed with this arrangement will be about six miles per hour, but by using more accumulators it can be worked up to eight. The steering handle and the brake occupy their usual positions, and at the left side of the rider is a commutator, by which the number of accumulators in the circuit can be altered, or the current cut off from the motor. The full power of the battery is only obtained by turning the switch of the commutator through the intermediate powers, so that shocks are avoided in starting the machine.

* * * * *

AGRICULTURAL CHEMISTRY.—Some experiments have been reported recently bearing on an interesting problem in Agricultural Chemistry, viz., the alteration of nitrates in the soil. A small vegetable organism, Bacillus armylobacter, has been discovered to be active in setting up a butyric fermentation in the ground. The organism has been examined while in an active condition, in a fermenting liquid which was prepared from earth mixed with sugar, and containing nitrates in small quantity. When this was kept at a temperature of 35°C. gas was given off, which was sometimes a mixture of CO_2 and hydrogen, and sometimes CO_2 with nitrogen and nitric oxide. At the same time the liquid smelt strongly of butyric acid, and the nitrates disappeared. The Bacillus described as effecting this change is widely distributed, and can be observed as a number of oblong particles collected into groups of two or three in liquids properly prepared. The nitrates in the soil are reduced by the hydrogen generated in the butyric fermentation, set up by the organism when it meets organic matters in the absence of oxygen.

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Publications Reviewed.

On Physical Education and its Place in a Rational System of Education. By Concordia Löfving. London: W. Swan Sonnenschein & Co.

We are very sorry not to be able to speak in unqualified praise of this lecture, which, extending to nearly 70 8vo pages, may be more properly termed a treatise. Miss Löfving is an earnest and zealous advocate of education in its fullest sense, and speaks, as we should expect from her charming portrait, with enthusiasm on all things in general that have a bearing, direct or indirect, on education. From the title of the book we look for hints at least, if not directions, on physical training, but of these the book contains scarcely anything, and merely refers us to Ling's method, the leading principles of which are cursorily glanced at. Miss Löfving speaks with almost amusing naïvety of her efforts and designs, and regards her lectures being welcomed in many places as 'a remarkable sign of the times.' She tells us that she is preparing a complete work on education, of which this pamphlet is a mere precursor. 'But seeing that it will take some time before I get my great work ready, and considering also the eager attention and good-will with which my lectures have been received by . . . the most prominent men in Europe, I cannot refrain from publishing them. Though I must say that to any one who has got his eyes open to the inner all-uniting oneness in the multiplicity of this phenomenal world, it is almost a sacrifice to have to give his mind out, so to say, piece-meal, falling so short of the ideal he has conceived.'

This will give a fair idea of the lofty—we had almost said inflated—style of the authoress, and of her fondness for hard and often scarcely understandable words. Yet this Johnsonian ponderosity is occasionally grotesquely mingled with words more approaching to slang than merely idiomatic terms. Between tasks for young people the authoress wisely enough recommends what we should call short *intervals*, but which she prefers to term *intercalations* for games, and just after this big word inspectors are told not to 'put the screw on' in regard to examinations. But we won't quarrel with fine words, though they tend to mar the usefulness of this book. We wish that the amiable and enthusiastic authoress had in the first place led us over a less extensive field and permitted us to rest longer and think more on the subject of her lecture. Next, that her suggestions on many important points were less vague and impracticable. For example, while recommending every conceivable subject for the curriculum of study, and 'ensured a general good parallelism in the subjects,' we have Sanscrit recommended as the right study for an adult, and for childhood, 'the beautiful and distinct sounds of the Italian, Spanish, and French languages as having an educative influence on the organs of speech.' Now against Sanscrit we have no word to say, and only wish it were more studied, if only for the clearness it gives to our ancient names, of rivers for instance. But we object to the hard, semi-nasal, disjointed sounds of the French being classed with the soft and vowel-abounding Italian. 'Only think,' says the authoress, 'what a corrective effect French, *if well taught from the beginning*, would have on the organs of speech of English children.' To which we may reply what a corrective effect would the pronounciation of English have on the organs of speech of a Frenchman, and also a German, who can never get over our *th*. As Herr Formes sang: 'And a moder she vash and ish to me,' and also Bret Harte, 'Bere is dat barty now?'

But we cheerfully acknowledge many wise and useful remarks in Miss Löfving's book, though most of these are old as the hills. Such, for instance, are her strictures against tight lacing, high-heeled boots, close-fitting bandages for infants, and other monstrosities of fashion and thoughtless custom. Still better are her condemnatory remarks against some gymnastic appliances, as parallel bars, which, she remarks, tend to push up the shoulders and injure the back. Again, on ventilation we are wholly with her, and lament the comparative uselessness of the swivel-swung window on account of its wrong slope. In regard to the impracticability of many of the suggestions we would notice Miss Löfving's recommendation that 'Each girls' school ought to have affiliated with it a model nursery, where a certain number of poor children could be received, and where the young girl could study their

treatment practically. She would there learn what is good for the child, as to food [the infant-cookery hobby would dove-tail capitally here], clothing, activity, rest, the proper care of its skin, and other organisations. She would there have the opportunity of watching its different stages of development, and the modifications in its treatment and *régime* in consequence thereof.' We fear our schoolmistresses will stand aghast at this. Cookery is bad enough, but what shall we say to the addition of a model nursery to every school?

We could have spared much of Miss Löfving's mysterious metaphysics for a few more remarks on the healthy training of girls. 'Man,' she tells us, 'is a universe in miniature, a plurality pointing towards or converging to a unity.' In regard to the action of the brain, while partially agreeing with the phrenologists, Miss Löfving tells us that 'persons of great mental activity and capability have the *gyri* or convolutions of the grey matter more numerous and more distinctly grooved than in the brains of people of less ability.' Probably our imperfect appreciation of many of Miss Löfving's speculations are owing to an imperfectly grooved *gyri*, or the grey matter of our brain not being sufficiently convoluted. One word as to the theological notions of Miss Löfving in regard to the Resurrection. We can understand the material notion that insists on the union of the natural body with the spirit, and we can also understand the Swedenborgian belief of the entire separate existence of spirit, in fact that there is a spiritual body as well as a natural body, and that the latter will not be required in the spiritual world. But Miss Löfving's hazy theory hereon puzzles us. She says that man has 'the hope of a more perfect union between spirit and matter, where the bodily element shall share immortality with the spirit.' Yet, 'the above, of course [why of course?], does not mean that the same body that you lay down in the tomb rises again; such an idea would be against Scripture (1 Corinth. xv. 37-44), as well as against the revelations of science respecting the circulation of matter!' We ought to apologise for thus introducing theology into physical education, but would with all gentleness suggest to Miss Löfving that such matters are inappropriate to her subject and militate against the utility of her pages. We have, however, much to commend and little to object to in these pages, notwithstanding their vast and rather vague range, and we must add, that of the good things brought forward by Miss Löfving far less are new than the gentle authoress seems to imagine.

Student's Manual of German Literature. By E. Nicholson, Author of 'Chronological Guide to English Literature.' Swan Sonnenschein and Co., Paternoster Row.

A catalogue *raisonnée* of the best Teutonic authors, with some account of their chief works, divided into seven periods, ranging from the fourth century to the nineteenth; and for an eighth giving a rapid list of writers of Germany, for the most part still living. The Gothic translation of the Bible, as the most ancient (for it was made in A.D. 388), is also the most interesting, and is named the Silver Codex. Among many others of the Saga sort, the famous Nibelungenlied is treated at the considerable length its importance deserves. It is impossible to name every noted German author, but Mr. Nicholson has here introduced his student wisely and widely to the best.

The Book of Shadows. London: Sonnenschein.

Some of these whimsicalities are ingenious, but others too far-fetched. It seems scarcely worth while for the labour of woodcuts to have been wasted on such silliness. However, it is but a sixpennyworth.

Cat and Dog Stories as told to one another. London: Sonnenschein.

Another of this firm's sixpenny series, and a very good one. The animal sketches are very clever, and the anecdotical letterpress quite the thing to improve the minds of children towards love of their home pets.

Sixth Reader. (Blackie's Graduated Readers.) Edited by Maurice Paterson. London: Blackie and Son.

Among the numerous competitors for scholastic patronage in the way of General Readers, we must award great praise to the one before us. We are disposed to be increasingly critical amid so many ordinary selections and compilations, but this book disarms all complaint and demands commendation on many points. In the first place, the selections are always good. Next, they are in many cases fresh, while some of the best old bits, both of prose and poetry, are retained. Further, we have a remarkably excellent set of notes appended to every lesson which admirably elucidate the text, and will thus save the teacher very much trouble. The questions also will probably be useful to many teachers, and need not be regarded as exhaustive if followed slavishly. To give some idea of the attractiveness of the contents, we may mention a series of extracts from Chaucer, hitherto almost neglected; several excellent lessons on scientific subjects mostly compiled; a judicious admixture of historical, legendary, poetical, and descriptive matter of general interest and most suitable to the upper standards.

Historical Reader. No. II. By George Girling. London: Blackie and Son.

This book forms one of Blackie's Comprehensive School Series, and gives an outline of English history from the commencement of the Tudor times to the present. Mr. Girling has carefully considered his subject, and shows great skill in presenting the most important facts in a style eminently suitable for junior standards. This style, while being simple, is free from the affectation of writing down to supposed imperfect comprehensions. In short, it is good, plain English, and in saying this we are saying much that we cannot say to many school histories. There is also a remarkable fairness throughout, though by no means a colourless spirit. A judicious admixture of political facts with the progress of the nation, also marks these chapters. In regard to the latter, we have such pleasant and truly instructive summaries as the following:—'In spite of the unsettled condition of affairs during the Civil War the country was advancing in material prosperity, and under the Commonwealth commerce received a great impetus. The population of the country in the reign of Charles II. was about five and a half millions. The cotton manufacture was introduced into the country during the early part of the period, and Manchester became its principal seat. Many of the great towns of the present day were small and insignificant, or were just rising into importance. The roads of the country were in a wretched state, and communication [was] difficult. In 1662 the Turnpike Act was passed, but there was no great improvement in the roads till the time of the Georges. At the end of the seventeenth century stage-coaches were introduced, and journeys from London to Chester, York, or Exeter took about four days in summer and six in winter.' In this agreeable fashion, the author gives us the most prominent features of English history. The book is also well got up, excellently printed, well illustrated, and strongly bound.

Historical Reader. No. III. Adapted to Standard V. of the Education Code. By George Girling. London: Blackie and Son.

This book comprises the outlines of the history of England from the British to the end of the Tudor period, and merits more than usual attention from the evident carefulness of the author in consulting good authorities and presenting his conclusions in a very suitable style. A remarkable spirit of fairness pervades the chapters, together with a departure from the beaten track of many old errors. In this latter respect we are struck with the clear

summary of Ancient Britain, the subject on which many mere compilers come to grief. Mr. Girling gives us a few leading authorities for his comprehensive sketch of this period. We only regret that this chapter is so short, but are thankful for its trustworthiness. The first Roman Invasion under Cæsar is dismissed in a short paragraph, of which we suppose we must not complain. But the traditional place where Cæsar crossed the Thames at his second invasion has become disputed, and may perhaps be better less confidently stated to be at Coway Stakes, near Chertsey. Staines and Kew Bridge each set up a claim in this respect. The Britons were not so destitute of military skill on the departure of the Romans as Mr. Girling would have us believe, but gave way before the Picts and Scots mainly through their internal differences and tribal quarrels. The sketch of the advance of Jutes, Saxons, and Angles is well summarised, as is also the general account of the Saxon period. We would willingly not except from this the legendary account of Alfred's gaining a book as a prize from his mother, Osberga, but this pretty little story must be relegated to the limbo of chronological anachronisms. Now and then we are treated to a pleasing little bit of etymology in explanation of names. That of 'King,' we are told, is from *Cyn*, a race or tribe, and *ing*, son of; hence *Cyning*, contracted to *king*, the son of the nation. 'The wife of the king (*cwen*, hence *queen*) originally shared the honours with her husband,' etc. It is pleasing to trace the meaning of this word *queen* or *cwen* to *white*, *bright*, or *shining*. Hence the old name of the White Sea was *Cwensea*, and from the same root—probably old Sanscrit—we have the names of *Kent*, *Kennet*, *Cann*, and others. A very much better account of the Saxon people and government is given by Mr. Girling than by many compilers. In this he has shown better judgment than by giving us many details of celebrities from the old Saxon chronicles. It is in this way of judicious selection that a good school history is most shown, and Mr. Girling has well succeeded in this particular. The get-up of the book is most satisfactory, being beautifully printed, well illustrated, and strongly bound. Many of the illustrations are facsimiles of old objects, such as the accoutrements of the Black Prince in Canterbury Cathedral; others are capital specimens of modern wood-engravings. There are also a goodly number of suitable and explanatory maps.

Stories of Old Renown, etc. Told by Ascot R. Hope; illustrated by Gordon Browne. Blackie and Son, Old Bailey.

This beautiful gift-book, perfect in paper, type, engravings, and most tasteful binding, deserves all our praise: the illustrator in particular outvieing Corbould in his knightly figures both of man and horse, and Richard Doyle in his humorous vignettes. Never was seen such a dragon as Sir Guy combats in p. 104 (more than a match for Turner's sublime monster on the ridgy Alp), while the sketch tournament (p. 34) of the brace of warriors transfixed by each other in the air with their horses butting like rams beneath is full of wit and wisdom. The stories, too, are well told, albeit sufficiently familiar; there is patient Griselda, worried for years by her capricious Marquis of Saluces, the most unreasonable and cruel husband ever invented; also, the much-maligned Genevieve of Brabant, tormented to her death by that base seneschal Golo; the tale of the false tutor Dissawar and his betrayed ward Roswall; of Robert of Sicily, a parallel for humbled pride with Nebuchadnezzar; of Guy of Warwick, and Ogier the Dane, and divers other impossible heroes of old time, whose records, founded in the humblest of barbaric fact, have come down to us in the most exaggerated form of incredible unreality. For example, we are told (p. 60) with respect to Charlemagne that 'A hundred knights [each], with a naked sword in one hand and a burning torch in the other, watched [as a matter of nightly custom] round the emperor's bed while he slept'—poor man, how could he sleep?—and 'when he went out to hunt, a hundred barons rode by his side'—it may be hoped, only to escort him to the covert. But let us not be prosaically critical on such picturesque descriptions. The book is, as we say above, worthy of all praise and deserves a great success.

Four Little Mischiefs. By Rosa Mulholland. Blackie and Son.

The children whose doings are recorded in this story really do get into such a series of scrapes, especially when staying at a country farmhouse, that they well deserve the name of 'Four Little Mischiefs.' But they are not bad children, only so fond of fun and frolic that even at their worst no one can be seriously angry with them, and their kind-hearted liberality when the poor little circus-rider meets with an accident proves the goodness of their dispositions. No doubt the story will find many little readers equally fond of mischief; but it is to be hoped they will not drive mother or nurse wild by imitating the pranks of Jork and Bunko.

Naughty Miss Bunny. By Clara Mulholland. A Story for Little Children. Blackie and Son.

Bunny is a dear little pickle of six, an only child who says 'it's because she feels lonely that makes her want to play tricks on people.' This is remedied by the arrival of a small boy cousin from India, but Bunny still remains delightfully naughty. She is quite a touch of nature, and will win the hearts of her readers.

The book is a pretty gift for a little girl, although the illustrations might be better. The cover is very attractive.

Chambers's Historical Readers. Book III. London and Edinburgh: W. and R. Chambers.

This book comprises the outlines of English history from the accession of Edward III. to the Stuart period. It is marked by impartiality and a disposition to give a truthful impression of the leading features of England during the Middle Ages. Occasionally useful observations occur elucidatory of the effects of great occurrences. As, in speaking of the French wars, the writer well observes that they tended to bind the English nation together. 'The races of Norman and Saxon forgot their differences, and learned to glory in the common name of Englishmen. They had marched and won side by side, and all classes felt a common pride in the country that could send forth such brave men.' As a proof of this, a statute was passed (in 1362), ordering that all proceedings in law should be conducted in English instead of in French, as had hitherto been the case. In fact, by this time the French spoken by the Normans had very much gone out of use, and had given way to the common popular speech, which Chaucer did much to bring into a permanent form. While the principal historical incidents are briefly described, due attention is paid to the social condition and progress of the people in material comforts. Of course such notices are but cursory, owing to the limits of the book, but what has been done has been well done. The book is well got up—printing, illustrations, maps, and binding being most commendable. Among the illustrations are some portraits—that of Raleigh, for instance—of unusual excellence. Judicious poetical extracts, chiefly from Shakespere, are agreeably interspersed among the prose lessons. Chronological and genealogical tables form useful appendages to the chapters.

Taunton Arithmetical Test Cards. In Six Packets for Standards II. to VII. By H. Allen. London: W. and R. Chambers.

This is, in all respects, an excellent set of cards. There are forty different cards (the colour of which varies with each standard) in each packet, in addition to two copies of answers on cards. It would be difficult to select a better set of exercises for use a month or two before the inspection.

We, therefore, cordially recommend Mr. Allen's Taunton Test Cards.

History of England for Standard IV. Part I. By A. H. Dick. London and Edinburgh: Gall and Inglis.

The author begins this little book with the first Roman Invasion of Britain. This is associated with a brief account of the Britons at that period, which is so misleading that we wish it were altogether omitted. The Druids are represented as a set of Thugs presiding over human sacrifices, notwithstanding opposite conclusions, together with the well-known fact that the Gauls sent their sons over to Britain for the advanced education under the Druids. In regard to the Saxon conquest, we have nothing better than the old exterminatory theory of the Britons that remained in their land together with the others being 'driven to the mountainous districts of Wales, Cornwall, and Cumbria,' wherever that may be. The sketch of the Saxon times, or rather of a few of the most prominent kings, is fairly told. Alfred, we hear, won for himself not only the name of *great*, but 'the no less distinguished title of "Founder of the English Monarchy."' This is not stated in any of the Saxon chronicles now recorded by any modern annalist of repute. The Norman rule is described in no unpleasing manner, and is gratefully free from tiresome dates of battles and mere names. In this respect it contrasts favourably with a host of repulsive skeletons that are made to do duty as histories for young readers. Of course we have the mythical story of the death of Rufus by Tyrrel's arrow, and after this has been dramatically given, even to the king's exclaiming, 'Shoot, Walter, shoot!' and 'As the words were spoken, the arrow came whizzing into the king's body, he fell, and died in a moment (1100),' we are in the next paragraph led into the path of historical scepticism in regard to this particularly detailed circumstance by the tantalizing question, 'Had Tyrrel shot the king?' which is more tantalizingly answered, 'No one knows.' The narrative, however, is in most other respects made up of less disputable stories, which are told generally in a moderately simple style. The account of the signing of Magna Charta tallies with local tradition. Runnymead, now better known as Egham Racecourse, lies between the Thames and the large village of Egham. In the midst of the river is a small island belonging to the Aukerwycke estate and named Magna Charta Island. On this is a cottage in which visitors are shown several things connected with the great historical event. The latter part of Mr. Dick's narrative comprises a sketch of Scottish history down to the early part of the fourteenth century, and thus includes the romantic careers of Wallace and Bruce. The book is well got up, and in regard to the illustrations the only fault we have to find is the gigantic stature of Peter the Hermit, who must have been at least ten or twelve feet in height, if we may judge by the size of his surrounding auditors.

History of England for Standard III. By A. H. Dick. London and Edinburgh: Gall and Inglis.

Much of the so-called history of the early part of this book had better remain unlearned. The general account of the Ancient Britons is erroneous, and a slavish following of exploded errors. There are already too many compilations founded on the authority of the shadowy Gildas, and which errors, having been scattered to the winds by modern authors of repute, it behoves compilers of history to avoid. Goldsmith and others, down to the irrepressible Pinnock, wrote according to their lights; the first with an inimitable charm of manner; but their lights have been shown to be in many cases set in very opaque lanthorns. If Mr. Dick has no opportunities of consulting the pages of Huxley, Nicholas, and other sound authorities, we recommend to his attention a clear little account of *Celtic Britain* by Professor Rhys, from which he may eliminate a host of errors he has made in the first part of his book. One or two instances will be sufficient to prove the truth of our objections. 'Ships,' Mr. Dick says, 'seldom came to the shores [of Britain], and did not come to bring things to the people, but only to get tin and lead.' We say nothing about this strained attempt at simplicity, but most well-read pupil-teachers could tell the author that the Britons *exported* not only metals of various kinds, but also corn, cattle, skins, fleeces, and especially a famous breed of dogs. They also imported, among other things, ivory, bridles, cups of amber, and drinking glasses. Such articles speak of a much higher civilization than that of savages, gratified with glittering beads and tinsel shreds of paper, in which condition Mr. Dick would have us believe the Britons to have been. Speaking of the Roman attack under Cæsar, we read, 'The poor naked Britons with their bows and arrows and soft copper swords (!) were soon driven on shore.' Strabo, some time before, giving us an account of the Britons, tells us that they were 'clad in black cloaks, with tunics, which reached to their feet, and girt about their breasts' (Geog. lib. iii. 5). The houses of the Britons were also, according to Cæsar—who wrote with an evident bias against his too stubborn foes—'after the manner of the Gauls,' and thus not the mere huts of wood and rushes, as stated by Mr. Dick. Further on he tells us that 'among the Britons coined money was unknown.' This error we may suppose Mr. Dick has fallen into from the fact that the Britons used iron and other rings for some purposes of barter. But has he never heard of British coins? Is he ignorant of Mr. J. Evans' book on 'The Coins of the Ancient Britons'? Has he never seen the beautiful specimens of Cunobelin and others, now to be examined in our national collection? As the song says:—

> 'If you look you will see 'em
> In the British Museum
> In Russell Street, Bloomsbury.'

Seriously, it is time such errors disappeared from our school-books, or modern scholarship is useless. We expect something even from compilations in the elimination of error. Otherwise the remark of the farmer to his son will be applicable to our scholars, that 'Book-larnin' don't seem to get you much forrarder.' The printing, illustrations, and binding of the book are thoroughly good.

Heroes of Maritime Discovery. By Davenport Adams. Gall and Inglis.

This otherwise pretty book has such an unattractive frontispiece, that one needs to consult page 8 to account for its ugliness: its hero being a hideous Patagonian, absurdly exaggerated. For the rest, twelve of our earliest adventurers contribute the interest of their exploits to the many excited schoolboys who will doubtless devour this able record thereof. It is curious that so great a name as that of Captain Cook should be omitted from the list of the Heroes, but perhaps a second volume will supply that and divers other such lackings. It is the more remarkable because one of the illustrations (and very good too), page 180, shows one of the gigantic idols of Easter Island, notably of Cook's early visiting, if not discovery; but Jacob Roggewein has here the glory of it. And the account here is of the greater importance, in that it shows there were in 1722 'many thousands of inhabitants' (page 178) in a little island now desolate and almost uninhabited, except by some 300 enormous stone images of ancient kings and priests! the explanation being that a slow subsidence of the land, as the crust of a volcanic plain, has gradually diminished this and other islands of the Pacific. In fine, Mr. Davenport Adams writes graphically, and the heroes he commemorates are worthy of all commendation.

Wesleyan Methodist Sunday-School Magazine. Vol. VIII. London: 2, Ludgate Circus Buildings.

This handsome volume cannot fail to prove of great service to all engaged in the religious training of the young. It is full of good things.

Junior Scholars' Tablet Book. Senior Scholars' Tablet Book. London: 2, Ludgate Circus Buildings.

Last year we noticed very favourably these neatly printed books, and have now equal pleasure in recommending the volumes for 1883 to mothers, Sunday-school teachers, and governesses. They are capital aids to Bible teaching.

Macmillan's Progressive German Course. First Year. By G. Eugène-Fasnacht. London: Macmillan and Co.

The fact that German is no longer looked upon as an 'extra' in our schools, but is beginning to form one of the essentials of a good education, especially among our girls, we see appearing on all sides new books and new methods for teaching German. But few authors have been so successful as Monsieur Fasnacht in providing us with an easy Primer suitable for the very beginners.

Concise clearness is the soul of good teaching, and the little book before us is both clear and concise. Each page consists of a short grammar lesson, a vocabulary of well-selected words, a model exercise in German, and some eight or ten English sentences for translation. As German grammar is one of the most difficult lessons a child has to master, we cannot speak too highly of this simple method, which at once puts him in possession of every material for constructing easy sentences, and rules for the proper use of that material.

We hear rumours of a new edition next spring, and we venture to suggest to the author that two slight additions would greatly add to the practical usefulness of his Primer. One is, that the definite article might be fully given in the first lesson instead of having to be gathered from different lessons, and the other, that some tabular form of the whole plan of the declension of nouns might be given on one sheet, by merely noting the *inflected terminations* themselves. It is utterly impossible otherwise to expect a child to have a clear idea of this most difficult subject. At present we are obliged to supply the defect by a separate table of declensions, but every one may not be fortunate enough to possess such an admirable substitute.

However, in spite of these serious drawbacks, we can heartily recommend this little book to every German teacher; and perhaps our recommendation may have some weight, when we say that, during the last two years, we have taught more than a hundred pupils with the help of no other grammar, and with the most successful results.

Greenwell's Test Cards. (Algebra, Euclid, and Mensuration.) By M. H. Senior. In Three Packets. London: Simpkin and Co.

These three packets are labelled A, B, and C, and are designed for Oxford and Cambridge juniors and for Higher Grade schools. Packet A contains addition, subtraction, brackets, definitions, axioms, and easy exercises on the square and rectangle; Packet B, multiplication, division, factors, simple equations, Bk. I., Prop. and Ex. from 1 to 32, and square and rectangle; Packet C, fractions, square root, equations, from Prop. 32, Bk.I., to end of Bk. II., and areas of rectilineal figures.

The Exercises are varied, and will furnish excellent test work for elder scholars and young pupil-teachers, as well as for Oxford and Cambridge juniors.

Graduated Exercises in English Grammar for Standard VI. By M. Hickey. London and Manchester: John Heywood.

This little book has conciseness and cheapness to recommend it—its price being only 2d. It is more definitive than explanatory, and abounds in the technicalities which have unhappily forced their way into the upper part of grammar termed analysis. For this, however, the author is neither responsible nor blameable. Yet it seemeth a matter for regre that the subject should be made dry, technical, and uninviting. Surely there is scope herein for some benevolent being to clothe these dry bones with living flesh. The definitions, however, of this little book are clear and accurate, and the exercises, selected from our best authors, well graduated.

Fairy Tales for Children: Tommy Greedy-grab and Wriggletum. By Joseph McKim, M.A. J. Heywood, Manchester and London.

Of the two stories contained in this little volume, both of slight construction, and not as cleverly written as might be, 'Tommy Greedy-grab' is decidedly the best; and all little schoolboys inclined to be lazy over their lessons, or given to greediness on the occasions of a hamper arriving from home, will do well to read Master Tommy's visit to the 'King of Tarts,' and if they follow his example they will be rewarded as he was, by finding how much more beloved he is when, on his return to school, he loses his nickname of 'Greedy-grab,' and is known henceforth by his proper cognomen 'Greenbank,' and is styled a 'brick' by his schoolfellows ever after.

(1) Jack the Giant-Killer. (2) Gulliver in Lilliput. (3) Gulliver in Brobdingnag. (4) Old Mother Hubbard.

Four of Nelson's wonderful sixpennyworths, the illustrations being firstrate, especially the 'Hubbard.' Whether or not young children should imbibe giant-killing, or can appreciate the satire of Lemuel Gulliver, are moot points enough; but at all events such stories must always be popular both in the nursery and elsewhere. The illustrations are triumphs of artistic excellence.

The Landseer Series of Picture Books. Parts I., II., III., IV. Edinburgh: Nelson and Sons.

If we could praise so heartily and so honestly Nelson's Nursery Series, what higher commendation must we not bestow upon this popular and picturesque glorification of Sir Edwin Landseer, the greater than Snyders of our time! Every one of these parts has the brightest-coloured engravings of best pictures, each worthy of a frame; and issued at a cost which might bring them into cottages. Modern art, especially in the way of oleography, must soon clear away from the humblest hovel-walls the rubbish which has so long been supposed to adorn them; and as a cheap method of popular education, such efforts as these of Nelson and Sons are essentially patriotic.

Won from the Waves; or, the Story of Maiden May. Griffith and Farran.

One of the late Mr. Kingston's graphic sea romances, for which he has long been so deservedly famous, especially with our juveniles. Of course, the foundling of the waves turns out to be a lady of high degree, and makes a great match at the marriage mart in the final chapter; and there is a whole bookful of nautical adventure, love-making, dialogue, and marine literature of a past generation, amply sufficient to satisfy readers who have the time and patience to peruse it thoroughly. The sixteen full-page illustrations are fair pictures of the archaic garb of a hundred years ago, but perhaps might in a sea-story have displayed more of naval incident, the figures being all on shore, and what Jack would call 'landlubbers;' from such a title one would have looked for storms, wrecks, sea-fights, and the like, whereas the artist gives us nothing but cottage interiors, domestic interiors, a wedding procession, and so forth. However, the pretty book will be popular (probably has been popular already this Christmas-tide) with schoolboys longing for the sea and schoolgirls looking out for gallant husbands.

A Wonderful Ghost Story. Griffith and Farran.

This little shilling book is a re-print of 'Mr. H.'s Own Narrative' from *All the Year Round*. It was published

in that magazine twenty years ago, so will be new to the present generation. The story is certainly wonderful, and there seems no reason to doubt its authenticity. There is one weak point in the narrative, however. The ghostly lady sits opposite Mr. Heaphy at dinner, invisible to the rest of the party, but nevertheless eats beef and drinks claret. The unprejudiced mind naturally asks the question, who carved the beef and who poured out the claret?

'Dolly Dear;' or, the Story of a Waxen Beauty. By Mrs. Gellie (M. E. B.). Griffith and Farran.

The little girl who finds among her Christmas gifts a prettily bound book with the above title will read with delight the adventures of the model doll, almost as large as a real baby, who plays so important a part in the lives of her young mistresses, and we venture to say that once begun it will not readily be laid down.

The interest of the tale is well sustained throughout, and it contains many truths and useful lessons which, laid to heart and practised by the reader, may have as good an effect upon her as 'Dolly Dear' herself had upon Eileen and Lizzie when ill in bed.

'St. Aubyn's Laddie,' and the Little Would-be Soldier. By E. C. Phillips. Griffith and Farran.

The little hero of this pathetic tale is Cyril St. Aubyn, always known by his pet name of 'Laddie,' and the would-be soldier is his cousin Alan, who is of the same age as himself, and has such a devoted affection for the little crippled invalid that he even gives up his cherished wish of being a soldier, and promises to remain with Cyril all his life. He is a high-spirited, determined little fellow, and though only seven and a half when he makes this promise, he keeps it faithfully, although at the cost of some tears; and when Cyril a few days before he dies wants to release him from his promise, he refuses, saying, 'No; if you don't want me to write your letters for you, I'll be an army doctor, and cure the sick and wounded soldiers, and be doctor to their wives and children when they are ill. Wouldn't that be nice?'

This satisfies Cyril, and Alan, glad to have made his cousin happy, says he never means to change again.

Cyril himself is a model of patience and thoughtfulness for others, and his influence his felt by all who know him. The story is one which will be read with interest by all who like this style of sorrowful literature.

The Belton Scholarship. By Bernard Heldmann. Griffith and Farran.

A story that will interest boys, treating as it does of school life, and coming from the pen of one already well known to them as a writer of similar tales.

The chief incident of the book is, of course, the competition for the scholarship; but there are many other scenes introduced that boys will appreciate, and in particular the account of the paper chase in Chapters VI. and VII. is very exciting, while the tragic affair of Charlie Stewart and the bull will arouse the sympathy of the reader.

In Belton school, as in other establishments of the kind, there are to be found boys of all tastes and temperaments, good and bad dispositions; for a school is a little world in itself, and the child is father to the man.

George Denton, the hero, is not faultless, but he has many good qualities which are brought out strongly when, by a reverse of fortune, he has to depend on himself, and industry and perseverance take the place of laziness and discouragement at his inability to learn as quickly as his companions. How he succeeds in his efforts, and who in the end wins the Belton, we leave our boy-readers to discover for themselves.

The Baby's Museum. Griffith and Farran.

A perfect collection of the 'rhymes, jingles, and ditties' which have lived and laughed in our nurseries from generation to generation, profusely and humorously illustrated. Quite the book for our little ones, and in the multitudinous woodcuts especially useful to rub out wrinkles from older foreheads.

White's Grammar School Texts. The Epodes and Carmen Sæculare of Horace, with an English Vocabulary. Longmans.

One of the numerous series in Greek and Latin classics issued in the interests of educational literature by Dr. White. A short account of Horatian metres precedes the text, which is followed by a full vocabulary: the whole comprising a most compendious manual for the numerous happy students of these easier times. What would not an old Carthusian or Etonian have given for such a trouble-saving help up Parnassus!

Longmans' Magazine. No. 2. December, 1882. London: Longmans, Green, and Co.

This is an excellent number, and promises well for the future of this new candidate for public favour. Dr. Smiles' 'John Harrison the Chronometer Maker,' and Mr. Froude's 'Norway Fjords,' are alone worth double the price of the magazine. We cordially recommend our readers who have not already seen 'Longmans' Magazine' to get a copy.

A Short Treatise on the Greek Particles, etc. By F. A. Paley, M.A., Editor of the Greek Tragic Poets, and Examiner to the University of London. Deighton, Bell and Co.

A learned, if so-called elementary, handbook for scholars who study the Greek classics microscopically. Mr. Paley is known as a distinguished educationalist, and has contributed several volumes to the series of *Bibliotheca Classica*, published by the eminent firm of George Bell and Co. This treatise is claimed by its author to be 'entirely original,' and he adds that as a concise manual it is probably unique, as explaining correctly the doctrine of the Greek particles. In this connection one cannot help remembering—and quoting—the famous triumph of rhyme and rhythm, *Browning's* 'Grammarian's Funeral,' where it is written—

> 'So, with the throttling hands of Death at strife,
> Ground he at grammar;
> Still, through the rattle, parts of speech were rife;
> While he could stammer
> He settled *Hoti's* business—let it be!
> Properly placed *Oun*—
> Gave us the doctrine of the enclytic *De*,
> Dead from the waist down!'

That Mr. Paley himself has full sympathy with such enthusiasm, let this extract from his preface suffice, viz.:—

'To my mind, then, so far from being a dry, unimportant subject, the combinations of the Greek Particles are full of the highest interest, as being, so to say, an elaborately finished part of a most complex and beautiful machinery. That a few inflected monosyllables should determine so completely the tone and meaning of a sentence is in itself a curious phenomenon of language. Believing that, from long and careful observation, I understand them myself, I have tried to make others do the same; and I only hope they will have the same pleasure in reading which I have had in writing this small work.'

Ivanhoe. Edition de Luxe. Part I. Ward and Lock.

This, perhaps the romance-masterpiece of Sir Walter Scott, is here so splendidly printed and so spiritedly illustrated as to be indeed what it professes, a luxury of literature. The excellence of the ancient matter 'goes without saying,' and the profuse modern embellishments by several French and English artists are worthy of the

text. The whole novel is to be issued in ten parts at a shilling, and it is hoped will amply recompense the enterprising 'House of Warwick,' now transferred to Salisbury Square.

Christmas and New Year's Cards. London: M. Ward and Co.

We have received from Messrs. Marcus Ward and Co. an excellent assortment of seasonable cards.

Songs for Little Singers. Composed by Henry King Lewis. Hodder and Stoughton.

'Songs for Little Singers' is a book of words and music well expressed by such a title. The words comprise forty-four selected hymns and pretty rhymes, mostly by well-known authors, and the musical settings to them, all composed by Mr. Lewis, are simple and tasteful if not very scientific. Those which please us most are 'His Little Child,' 'Thy Kingdom Come,' 'Benediction,' 'Little Things,' and 'Alice's Supper.' Some of the airs are more original than others, but, on the whole, we can heartily recommend this pretty book as supplying a want that has long been felt in giving the children songs to sing which they can understand and enjoy, and which express the real feelings of childhood.

The Teachers' Diary and Pocket Book. London: Jarrold and Sons.

Many a hard-worked teacher will thank the Messrs. Jarrold for the timely issue of this admirable, and, we might add, much-needed volume. If regularly used, it will save no end of trouble and worry. Its comprehensiveness may be gathered from the fact that it is adapted to the wants of either master, mistress, or pupil-teacher.

'The head master, by using it, will have always at hand any information he may require, without having to turn first to one page and then to another of the Code and the Instructions to Inspectors; all the information bearing on the same subject being put together.

'He will also find useful the form on which to enter the time table for each standard; and the space for observations on the work of the standard, results of his examinations, etc., during the year.

'The head mistress, in addition to the above, will find the needlework requirements for each standard, together with the exercises that may be set on the day of examination.

'The Assistant or Pupil Teacher will find in it:—

(*a*) The *work of his class* set out, whatever standard he may be taking;

(*b*) Information from the "Circular to Inspectors," as to *what will secure a pass* in each subject;

(*c*) A form on which to enter the *time table of his class*;

(*d*) A space for entering *notes on the work of his class*; and (if a pupil-teacher),

(*e*) A full statement of *what* he has *to study* in each subject *for his own examination*, not only for the year, but right up to the time when he goes to the Training College.'

We heartily recommend 'The Teachers' Diary and Pocket Book' to every elementary teacher in the country.

[Several Reviews are unavoidably left over for want of space.]

Publications Received.

Christmas Cards—
(1) Marcus Ward's Christmas Cards. Marcus Ward and Co.

Classics—
(1) Horace. Epodes and Carmen Seculare (White's Grammar School Texts). Longmans.

Diagrams—
(1) Johnston's Standard Series of School Diagrams. No. 1. Chemical Apparatus, mounted on rollers. A. Johnston.
(2) Johnston's Illustrations of Natural Philosophy. Sheets No. 7 and 7½ with Handbooks. A. Johnston.

English Grammar—
(1) Hickey's Graduated Exercises in English Grammar. For Standard VI. John Heywood.
(2) Blackie's English Grammar. Standards 2, 3, 4, 5, 6, and 7. Blackie and Son.

Euclid—
(1) Nop's Class Lessons on Euclid. Books 1 and 2. Kegan Paul and Co.

Geography—
(1) Spence's Geography: 'Civil Service Series.' Crosby, Lockwood and Co.

German—
(1) Wortfolge, or Rules and Exercises on the Order of Words in German Sentences with Vocabulary. G. Bell and Co.

History—
(1) Stories from English History for Standard III. Gall and Inglis.
(2) History of England. Part I. for Standard IV. Gall and Inglis.

Latin—
(1) Introduction to Latin Prose Composition. By R. M. Milington. Longmans.

Literature—
(1) Shakespeare's Julius Cæsar. Longmans.
(2) Selections from Julius Cæsar. Longmans.

Mechanics—
(1) Garnett's Elementary Mechanics. G. Bell and Sons.
(2) Besant's Hydro-Mechanics. G. Bell and Sons.

Mensuration—
(1) My First Mensuration. By M. H. Senior. Greenwell.

Miscellaneous—
(1) Heroes of Maritime Discovery. Gall and Inglis.
(2) The Belton Scholarship. Nelson and Sons.
(3) Tommy Greedygrab and Wriggletum. John Heywood.
(4) Universal Instructor. Vol. II. Ward, Lock, and Co.
(5) Our Dolly. Griffith and Farran.
(6) St. Aubyn's Laddie. Griffith and Farran.
(7) Won from the Waves. Griffith and Farran.
(8) The Teachers' Diary and Pocket Book. Jarrold and Sons.
(9) Four Little Mischiefs. Blackie and Son.
(10) Naughty Miss Bunny. Blackie and Son.
(11) Stories of Old Renown. Blackie and Son.
(12) A Wonderful Ghost Story. Griffith and Farran.
(13) Two Bible Cartoons. Wesleyan Methodist Sunday School Union.
(14) Two Illustrated Readings. Wesleyan Methodist Sunday School Union.
(15) Philip Phillips' Story of His Life. Wesleyan Methodist Sunday School Union.
(16) School-Room Placard. No. 1. Wesleyan Methodist Sunday School Union.
(17) Wesleyan Sunday School Magazine. Vol. 1882. Wesleyan Methodist Sunday School Union.
(18) Scholars' Tablet Book for 1883. Wesleyan Methodist Sunday School Union.
(19) Our Boys and Girls. Vol. 1882. Wesleyan Methodist Sunday School Union.
(20) True Stories of Foreign History. Blackie and Son.

New Code—
(1) Handbook of the New Code. By J. F. Moss. Isbister.

Periodicals and Magazines—
(1) Longmans' Magazine. No. 2. Longmans.
(2) Weldon's Ladies' Journal. Christmas Double Number. Weldon and Co.
(3) Book of Sports and Pastimes. Part IX. Cassell and Co.
(4) Our Little Ones. Vol. III. No. 2. Griffith and Farran.
(5) Universal Instructor. Part XXVI. Ward, Lock, and Co.
(6) Edition de Luxe of the Waverley Novels. 'Ivanhoe.' Ward, Lock, and Co.
(7) Gage's School Examiner and Student's Assistant. Gage and Co.

Readers—
(1) 'Longmans' Modern Series' Illustrated Reader Primer. Longmans.
(2) History Readers. No. 1. Marcus Ward and Co.

Test Cards—
(1) Greenwell's Test Cards. A. B. C. Greenwell.

Query Column.

☞ As the answer to a single question often entails an expense six or seven times greater than the cost of the complete key to any of the Arithmetics or Algebras ordinarily used, the Proprietor of this Journal would be glad if students confined themselves to questions, the full working of which is not published in the form of a 'key.'

RULES.

1. Each correspondent is restricted to *one question*. We should be much obliged if correspondents who send numerical or algebraical questions for solution, and are able from any source to give the required answer, would do so. It would save much time at present spent on verification.

2. No query can be answered unless accompanied by the real name and address of the sender, not necessarily for publication, but as a guarantee of good faith and for facility of reference.

3. Replies will not be sent through the post.

4. Correspondents are requested to write *legibly*, and on one side of the paper only.

5. Correspondents wishing us to recommend books for any (other than the ordinary Government) Examinations, or to answer any questions concerning that Examination, must, in all cases, send a copy of Regulations up to date.

6. Queries must reach the office *not later than the 15th of the month*, or they cannot be attended to in the following issue.

7. All queries in future must have a pseudonym, and must be written on a slip of paper other than that which bears the real name and address of the sender.

*** All communications for this column should be addressed

'The Query Editor,'
The Practical Teacher,
Pilgrim Street, Ludgate Hill,
London, E.C.

Arithmetic.

1. AMEY JONEY.—If a person buy pins when they are 18 in a row, and sell them 11 in a row at the same price, how much is the gain per cent. on the outlay?

11 : 100 :: 7 : Gain per cent.
$= \frac{700}{11}$
$= 63\frac{7}{11}$ per cent. Ans.

2. CHOKRA.—A reduction of 30 per cent. in the price of eggs would enable a purchaser to obtain 54 more for a guinea. What may the present price be?

$\underset{7\not{0}}{\pounds} : \underset{3}{s.} :: \underset{\not{4}}{\pounds} : 10\not{s}$: Present price of the eggs that would be obtained for a guinea after reduction
= 30s.
∴ Present price = 54 for (30s. − 21s.)
= 54 for 9s.
= 6 for 1s.
= 2d. each. Ans.

3. ROMEO.—Find the G. C. M. and L. C. M. of $3\frac{1}{3}$, $4\frac{1}{2}$, $6\frac{1}{4}$, and $8\frac{1}{5}$.

$= \frac{10}{3}, \frac{9}{2}, \frac{25}{4}, \frac{41}{5}$;

G. C. M. of numerators = 1
L. C. M. ,, denominators = 120
∴ G. C. M. $= \frac{1}{120}$. Ans.
L. C. M. of numerators = 19,600
G. C. M. ,, denominators = 1
∴ L. C. M. = 19,600. Ans.

4. STUDENT.—Simplify

$$\left(\frac{1.01+.01}{1.01-.01}-\frac{1.01-.01}{1.01+.01}+\frac{.0004}{1-.00001}\right)\times\left(\frac{1.01+.01}{.02}\right),$$

the answer to be given as a vulgar fraction. (*Rick's* 'Arithmetic for Pupil Teachers.)

$$\left(\frac{1.01+.01}{1.01-.01}-\frac{1.01-.01}{1.01+.01}+\frac{.0004}{1-.00001}\right)\times\left(\frac{1.01+.01}{.02}\right)$$
$$=\left(\frac{1.11}{.09}-\frac{.09}{1.11}+\frac{.0004}{.09999}\right)\times\frac{1.11}{.02}$$
$$=\left(1\tfrac{2}{9}-\tfrac{9}{111}+\tfrac{4}{9999}\right)\times 55\tfrac{1}{2}$$
$$=\frac{12221-8181+40}{9999}\times 55\tfrac{1}{2}$$
$$=\frac{12261-8181}{9999}\times 55\tfrac{1}{2}$$
$$=\frac{\overset{680}{\not{4}\not{0}\not{8}}}{\underset{9\not{9}\not{9}}{\not{4}\not{0}\not{8}\not{5}}}\times\frac{11}{\not{2}}$$
$$=\frac{303}{\not{9}\not{9}\not{9}}\times\frac{11}{\not{2}}$$
$$=\frac{3333}{1000}$$
$$=2\tfrac{333}{1000}. \text{ Ans.}$$

5. T. H. B.—If I invest in 3 per cents. at 72, and on their rising to 80 sell out and invest the proceeds in a 4 per cent. stock at 96, thereby increasing my income £43 10s., find the sum at first invested.

Income on an investment of £72 in 1st case = £3;
,, this ,, on transferring
$$= £4 \times \frac{\overset{10}{\not{8}\not{0}}}{\underset{3}{\not{9}\not{6}}}$$
$$= £3\tfrac{1}{3};$$
Increase in income on this investment = $£3\frac{1}{3} - £3$
$= £\frac{1}{3}$;
∴ Sum invested = $£72 \times \frac{43\frac{1}{2}}{\frac{1}{3}}$
$$= £\left(\overset{36}{\not{7}\not{2}} \times \frac{261}{\not{2}}\right)$$
$$= £9396.$$

6. A. T.—Distribute £17 amongst 13 persons, so that the persons being taken in order, each after the first may receive 2s. 6d. more than the person immediately preceding him; also find how much money will remain, for want of a coin of less value than a farthing.

2s. 6d. × (12+11+10+9+8+7+6+5+4+3+2+1)
= 2s. 6d. × 78
= £9 15s.;

(£17 − £9 15s.) ÷ 13
= £7 5s. ÷ 13
= 11s. $1\frac{1}{2}$d. $\frac{1}{13}$q.

∴ Shares = 11s. $1\frac{1}{2}$d., 13s. $7\frac{1}{2}$d., 16s. $1\frac{1}{2}$d., 18s. $7\frac{1}{2}$d., £1 1s. $1\frac{1}{2}$d., £1 3s. $7\frac{1}{2}$d., £1 6s. $1\frac{1}{2}$d., £1 8s. $7\frac{1}{2}$d., £1 11s. $1\frac{1}{2}$d., £1 13s. $7\frac{1}{2}$d., £1 16s. $1\frac{1}{2}$d., £1 18s. $7\frac{1}{2}$d., and £2 1s. $1\frac{1}{2}$d.

Amount remaining = 5 farthings = $1\frac{1}{4}$d.

7. HENRY.—Divide £16,984 among A, B, C, and D, so that A's share : B's share :: 6 : 5, B's share : C's share :: 2 : 3, and C's share : D's share :: 4 : 3. (*Barnard Smith.*)

B's share = $\frac{5}{6}$ of A's;
C's ,, = $\frac{2}{3}$ of B's
= $\frac{2}{3}$ of $\frac{5}{6}$ of A's
= $\frac{5}{9}$ of A's;
D's ,, = $\frac{4}{3}$ of C's
= $\frac{4}{3}$ of $\frac{5}{9}$ of A's
= $\frac{20}{27}$ of A's;
∴ A's share = £16,984 ÷ $(1+\frac{5}{6}+\frac{5}{9}+\frac{20}{27})$
= £16,984 ÷ $\frac{353}{162}$
= £(88 × 48)
= £4224;
B's share = $\frac{5}{6}$ of £4224 = £3520;
C's ,, = $\frac{5}{9}$,, = £5280;
D's ,, = $\frac{20}{27}$,, = £3960.

8. PUZZLED.—A tradesman has on his books 960 customers, whose monthly custom averages in each case £5; he sends out his bills at the close of each month and allows 5 per cent. discount to each who pays ready money, but charges 2½ per cent. interest for each complete calendar month for all outstanding bills; at the end of a certain month one-half of these bills have been outstanding for one month, one-third for two, and the rest for three months; find the ratio of ready-money customers to the others, if the discount paid to them is equal to the interest charged to the others. (Certificate, 1880.)

Discount on ready-money payments = $\frac{1}{20}$ of (£5 × No. of ready-money customers);
Interest on outstanding bills for 3rd month
= $\frac{1}{40}$ of (£5 × $\frac{1}{2}$ No. of other customers)
+ $\frac{1}{60}$ of (£5 × $\frac{1}{3}$,, ,, ,, ,,)
+ $\frac{1}{80}$ of (£5 × $\frac{1}{6}$,, ,, ,, ,,);
Interest on outstanding bills for 2nd month
= $\frac{1}{40}$ of (£5 × $\frac{1}{3}$ No. of other customers)
+ $\frac{1}{60}$ of (£5 × $\frac{1}{6}$,, ,, ,, ,,);
Interest on outstanding bills for 1st month
= $\frac{1}{40}$ of (£5 × $\frac{1}{6}$ No. of other customers);
∴ Total interest on outstanding bills
= $\frac{1}{40}$ of (£5 × $\frac{1}{2}$ No. of other customers)
+ $\frac{1}{60}$ of (£5 × $\frac{1}{3}$ No. of other customers)
+ $\frac{1}{80}$ of (£5 × $\frac{1}{6}$ No. of other customers)
= £5 × $\left\{(\frac{1}{40}\text{ of }\frac{1}{2})+(\frac{1}{60}\text{ of }\frac{1}{3})+\left(\frac{1}{40}\text{ of }\frac{1}{\frac{1}{2}}\right)\right\}$ of No. of other customers
= £5 × $(\frac{1}{80}+\frac{1}{80}+\frac{1}{80})$ of No. of other customers
= £5 × $\frac{3}{80}$ No. of other customers;
∴ £5 × $\frac{1}{20}$ No. of ready-money customers
= £5 × $\frac{3}{80}$ No. of other customers;
∴ No. of ready money customers : No. of other customers
:: $\frac{1}{20}$: $\frac{3}{80}$
:: 5 : 3.

9. SNOWDROP.—Find the value of $13\cdot27\dot{5}$ of 2 ac. 3 ro.

$13\cdot27\dot{5} = 13\frac{275-2}{990} = 13\frac{273}{990} = 13\frac{91}{330}$;
2 ac. 3 ro. × 13 = 35 ac. 3 ro.;
2 ac. 3 ro. × $\frac{91}{330}$ = 250 ac. 1 ro. ÷ 330
= 3 ro. 1 po. 10 yds. 108 in.
∴ Value = 35 ac. 3 ro. + 3 ro. 1 po. 10 yds. 108 in.
= 36 ac. 2 ro. 1 po. 10 yds. 108 in. Ans.

10. GRACIE.—A cistern can be filled by two pipes, A and B, in 4 minutes and 5 minutes respectively, and emptied by C in 2½ minutes. A is opened for 2 minutes, and then A and B together for one minute more, when C is also opened. In what time would the cistern which now contains 361 gallons be full, and how many gallons would have passed through A and B respectively?

Part filled by A in 2 minutes = $\frac{1}{4} \times 2 = \frac{1}{2}$,
,, ,, ,, A and B in 1 minute = $\frac{1}{4} + \frac{1}{5} = \frac{9}{20}$,
∴ ,, ,, in the 3 minutes = $\frac{1}{2} + \frac{9}{20} = \frac{19}{20}$,
Part remaining to be filled = $\frac{1}{20}$;
Part emptied by C in 1 minute = $\frac{1}{2\frac{1}{2}} = \frac{2}{5}$,
,, filled in one minute when all are open
= $\frac{9}{20} - \frac{2}{5} = \frac{27-25}{60} = \frac{1}{30}$,
∴ The cistern will be full in $(\frac{19}{20} \div \frac{1}{30})$ min.
= $\frac{57}{2}$ min.
= 1½ min. Ans.

The cistern holds $(361 \times \frac{20}{19})$ gallons
= 380 gallons;
∴ Quantity passed through A = $\left(380 \times \frac{4\frac{1}{2}}{4}\right)$ gals.
= $\frac{95 \times 9}{2}$ gals.
= 472½ gals. Ans.
,, ,, ,, B = $\left(380 \times \frac{2\frac{1}{2}}{5}\right)$ gals.
= 190 gals. Ans.

11. NO NAME.—There are two vessels, one containing 12 gallons of water, and the other 6 gallons of wine; if a gallon be taken out of each, and poured into the other, and if this be repeated 4 times, find how much water and wine will be in each? (*Johnstone's* 'Arithmetic).

After first exchange—
First contains 11 gals. of water, and 1 gal. of wine,
Second ,, 5 ,, ,, wine, ,, 1 ,, ,, water:
After second exchange—
First contains $(11-1\frac{1}{12}+\frac{1}{6})$ gals. of water, and $(1-\frac{1}{12}+\frac{1}{6})$ gals. of wine,
,, ,, 10½ gals. of water, and 1¼ gals. of wine,
Second ,, 4½ ,, ,, wine, ,, 1¾ ,, ,, water:
After third exchange—
First contains $(10\frac{1}{4}-\frac{9}{16}+\frac{7}{24})$ gals. of water, and $(1\frac{3}{4}-\frac{7}{16}+\frac{1}{24})$ gals. of wine,
,, ,, 9$\frac{19}{48}$ gals. of water, and 2$\frac{5}{48}$ gals. of wine,
Second ,, 3$\frac{29}{48}$,, ,, wine, ,, 2$\frac{5}{48}$,, ,, water:
After fourth exchange—
First contains $(9\frac{19}{48}-1\frac{55}{96}+\frac{35}{144})$ gals. of water, and $(2\frac{5}{48}-\frac{35}{96}+\frac{5}{144})$ gals. of wine,
,, ,, 9$\frac{17}{24}$ gals. of water, and 2$\frac{7}{24}$ gals. of wine.
Second ,, 3$\frac{7}{24}$,, ,, wine, ,, 2$\frac{7}{24}$,, ,, water.

12. F.S.—If the three per cent. consols are at 81¼, what must be the price of the five per cents., that there may be no loss of income in selling out of the former, and reinvesting in the latter, allowing for the usual brokerage of ¼ per cent. of stock on each transaction? (*Civil Service Examination for Excise, Nov.*, 1880.)

£ £ £
3 : 5 :: 81¼ : Price of stock with brokerage,

3 | 5 / 408¾
£136¼

∴ Price of the five per cents. = £136¼ − £¼
= £136 Ans.

13. ANXIOUS.—The price of £100 bank stock which pays 6½ per cent. is 185¼. £6,250 of this stock is transferred to the three per cent. consols at 92¾; find the alteration in income.

Interest on Bank stock = £(62½ × 6½)
= £406 5s.;
Amount of stock in consols = £$\left(6{,}250 \times \frac{185\frac{1}{2}}{92\frac{3}{4}}\right)$
= £(6,250 × 2)
= £12,500;
Interest on consols = £(125 × 3)
= £375;
∴ Alteration in income = (£406 5s. − £375) decrease
= £31 5s. decrease. Ans.

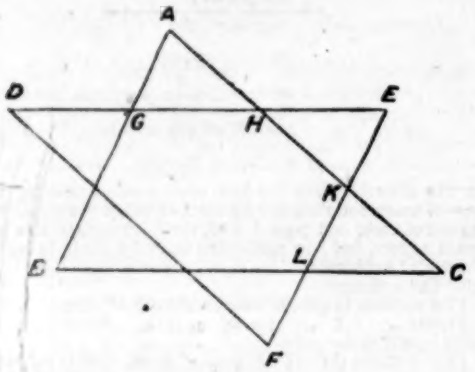
NOTE.—Writing pretty fair, but too thick.

14. KAPPA.—Two settlers in New Zealand own adjoining farms of 3,000 and 5,000 acres respectively. They unite their farms, taking at the same time an additional partner, who pays them £8,000, on the understanding that a third share of the land shall in future belong to each. How is the £8,000 to be divided between the original owners?

Size of each farm after division = $\frac{3000+5000}{3}$ acres
= 2,666⅔ acres;
∴ Value of an acre = £8,000 ÷ 2,666⅔
= £3;
Quantity taken from first settler = (3,000 − 2,666⅔) acres
= 333⅓ acres;
∴ First settler should receive (333⅓ × 3) £
= £1,000,
And second ,, ,, ,, £7,000.

Geometry.

1. CONSERVATIVE.—If the sides of a triangle be trisected, and lines be drawn through the points of section adjacent to each angle, so as to form another triangle, this shall be in all respects equal to the first.



Let ABC be the given triangle, and let the triangle DEF be formed by drawing lines through the points of trisection of the sides adjacent to the angles.

Then the triangle DEF shall be equal in all respects to the triangle ABC.

Proof.—Because GB is double of AG,
∴ triangle GHB is double of triangle AHG;
similarly, triangle HGG is double of triangle AHG;
∴ triangle GHB is equal to triangle HGC;
wherefore GH is parallel to BC. (I. 39.)

Therefore the triangles DEF has its sides respectively parallel to the sides of the triangle ABC.

In the triangles AHG, KHE,
the angles HAG, AGH = angles HKE, KEH, each to each, (I. 29.)
and side AH = side KH,
∴ side AG = side KE; (I. 26.)
similarly, it can be proved that LK = KE, and FL = LK;
∴ EF is treble of EK, and therefore equal to AB.
Similarly, it can be proved that DE = BC, and DF = AC.
∴ Triangle DEF is equal to triangle ABC in all respects.
Q. E. D.

2. INQUISITIVE.—(1) Deduce from Euclid II. 11, that $AB^2 + BH^2 = 3AH^2$.

(2) If m and n are any numbers, and lines be taken whose lengths are $m^2 + n^2$, $m^2 - n^2$, and $2mn$ units respectively, show that these lines form a right-angled triangle.

(1) $AB^2 = AH^2 + BH^2 + 2AH.BH$ (II. 4.)
$AB^2 + BH^2 = AH^2 + 2BH^2 + 2AH.BH$ (Ax. 2.)
$= AH^2 + 2(BH^2 + AH.BH)$
$= AH^2 + 2AB.BH$ (II. 3.)
$= AH^2 + 2AH^2$ (II. 11.)
$= 3AH^2$. Q. E. D.

2. $(m^2 - n^2)^2 + (2mn)^2 = m^4 - 2m^2n^2 + n^4 + 4m^2n^2$
$= m^4 + 2m^2n^2 + n^4$
$= (m^2 + n^2)^2$.

As the square of $m^2 + n^2$ is equal to the sum of the squares of $m^2 - n^2$ and $2mn$, the lines representing those units will therefore form a right-angled triangle. (I. 47.) Q. E. D.

3. EGS.—Given two points, find two other points that shall be at the same given distance from each of them. What is the least possible length of the given distance? (Scholarship, 1876.)

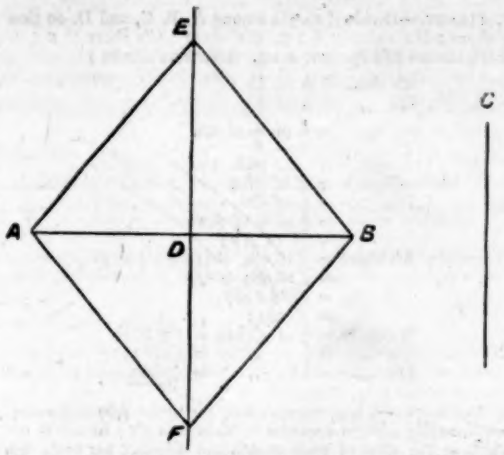
Let A, B be the two given points, and C the given distance.

Join A B, and bisect it in D. (I. 10.)

Draw EDF at right angles to AB. (I. 11.) From A as centre with C as radius cut EF in E and F, then E, F shall be the two points required.

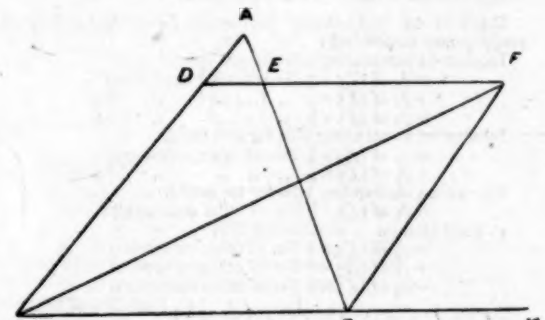
Join A E, B E, A F, B F.

Proof.—In the triangles ADE, BDE,
the two sides AD, DE = the two sides BD, DE, each to each,
and the angle ADE = the angle BDE, (Ax 11)
therefore AE = BE; (I. 4.)
Similarly it can be proved that AF = BF;
and AE, AF = the given distance C, (Def. 15.)
Therefore E, F are the two points required. Q. E. F.



The least possible length of the given distance is half the line joining the two given points, and then the two points coincide.

4. PUZZLER PERPLEXED.—Draw a line DE parallel to the base BC of a triangle ABC, so that DE is equal to the difference of BD and CE.

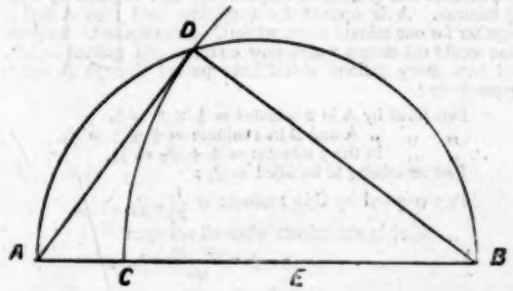


Produce BC to K. Bisect angles ABC, ACK by BF, CF (I. 9) meeting in F. Through F draw FED parallel to BC. (I. 31.)

Then DE shall be equal to the difference of BD, CE.

Proof.—The angle DBF = the angle CBF, (Con.)
and the angle CBF = the angle BFD, (I. 29.)
∴ the angle DBF = the angle BFD (Ax. 1);
wherefore BD = DF; (I. 6.)
Similarly it can be proved that CE = EF.
Now, DF = DE and EF,
= DE and CE;
∴ BD = DE and CE;
wherefore DE = the difference of BD and CE. Q. E. F.

5. SENEGAR.—Divide a given straight line into two parts, so that the difference of the squares on the whole line and on one of the parts may be equal to a given rectangle, which is not greater than the square on the whole line.



Let AB be the given straight line. Describe a square equal to the given rectangle (I. 14.), and make BC equal to the side of the square.

Upon AB describe the semicircle ADB.

From B as centre with BC as radius cut this semicircle in D. Join BD, AD, and make AE equal to AD.

Then the difference of the squares on AB, AE is equal to the square on BC, that is, the given rectangle.

Proof.—The angle ADB is a right angle (III 3);
therefore square on AB = squares on BD, AD (I. 47)
= squares on BC, AE;
wherefore square on BC = difference of squares on AB, AE (Ax. 3.)

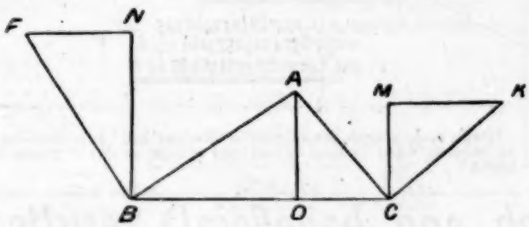
Therefore AB is divided in the point E, so that the difference of the squares on AB, AE is equal to the given rectangle.

Q. E. F.

6. M. McN. G.—In the figure of Euclid I. 2, if the diameter of the smaller circle is the radius of the larger, show where the given point and the vertex of the constructed triangle will be situated. (*Todhunter.*)

In this case, the given point and the vertex of the triangle will be situated on the circumference of the smaller circle.

7. MATHEMATICS.—If, in the figure to Euclid I. 47, DB be produced to meet a perpendicular from F in N, and EC to meet a perpendicular from K in M, and if AL meet BC in O, prove that FN and KM are each equal to AO, that BN is equal to BO, and CM to CO; also that the two triangles BNF and CMK are together equal to the triangle ABC.



Proof.—The angle ABF = the angle OBN, (Ax. 11.)
∴ the angle NBF = the angle ABO; (Ax. 3.)
wherefore in the triangles BNF, AOB,
the angles BNF, NBF = the angles AOB, ABO, each by each,
and the side BF = the side AB,
∴ therefore the triangles are equal in all respects; (I. 26.)
wherefore FN = AO, and BN = BO,
also triangle BNF = triangle AOB.
Similarly it can be proved that KM = AO, CM = CO, and triangle CMK = triangle AOC.
Again, triangle BNF = triangle AOB,
and triangle CMK = triangle AOC,
∴ triangles BNF, CMK together = triangle ABC. (Ax. 2.)

Q. E. D.

Algebra.

1. FRONT-DE-BŒUF, Leamington.—Find the sum of the pyramidal numbers 1, 4, 10, 20, 35,.....to n terms.

The following series form what are called the different orders of *figurate numbers*:

1st order, 1, 1, 1, 1, 1,.....
2nd ,, 1, 2, 3, 4, 5,.....
3rd ,, 1, 3, 6, 10, 15,.....
4th ,, 1, 4, 10, 20, 35, ...
.....

The general law is, that the n^{th} term of any order is the sum of n terms of the preceding order. Thus the n^{th} term of the second order is n, of the third order is $\frac{n(n+1)}{1\cdot 2}$, of the fourth order is $\frac{n(n+1)(n+2)}{1\cdot 2\cdot 3}$, and generally the n^{th} term of the r^{th} order is $\frac{n(n+1).....(n+r-2)}{\lfloor r-1}$.

∴ Sum of r^{th} order to n terms $= \frac{n(n+1)(n+2).....(n+r-1)}{\lfloor r}$;

Hence sum of the series 1, 4, 10,.....to n terms

$$= \frac{n(n+1)(n+2)(n+4-1)}{\lfloor 4}$$

$$= \underline{\tfrac{1}{24}\, n(n+1)(n+2)(n+3).}$$

Mensuration.

1. J. EDWARDS, Burton-on-Trent.—Find, in gallons, by Hutton's general rule, the volume of a cask, length 46·9 in., bung diameter 30·6 in., head diameter 26·1 in. Also find, in gallons, the wet ullage of a standing cask, length 30½ in., bung diameter 27¼ in., head diameter 23 in., wet ullage 10 in. (*Excise Exam.*, May, 1882.)

Dr. Hutton's general rule for finding the volume of a cask:—Add into one sum 39 times the square of the bung diameter, 25 times the square of the head diameter, and 26 times the product of the two diameters; then multiply this sum by the length, and the product again by ·000031½ for the content in gallons. (The dimensions of the cask must be expressed in inches.)

$(30\cdot6)^2 \times 39 = 36,518\cdot04$
$(26\cdot1)^2 \times 25 = 17,030\cdot25$
$30\cdot6 \times 26\cdot1 \times 26 = 20,765\cdot16$
$74,313\cdot45$
$46\ 9$
$668821\ 05$
44588070
29725380
$3485300\cdot805$
$\cdot000031\frac{1}{2}$
3485300805
10455902415
154902258
$109\cdot593347535$
$= \underline{109\cdot59 \text{ gals. Ans.}}$

$30\frac{1}{2}$ in. $- 10$ in. $= 20\frac{1}{2}$ in.

Mean diameter of occupied portion $= 27\frac{1}{4} - \frac{(20\frac{1}{2})^2 \times (27\frac{1}{4} - 23)}{(30\frac{1}{2})^2}$

$$= 27\tfrac{1}{4} - \frac{\frac{1681}{4} \times \frac{17}{4}}{\frac{3721}{4}}$$

$$= \tfrac{109}{4} - \tfrac{28577}{14884}$$

$$= \frac{405589 - 28577}{14884}$$

$$= \tfrac{377012}{14884}$$

$$= \tfrac{94253}{3721};$$

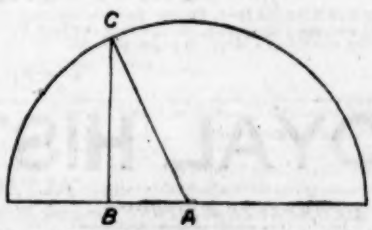
Wet ullage $= (\tfrac{94253}{3721})^2 \times 10 \times \cdot0028326$

$$= \tfrac{8884880809}{13845841} \times \cdot0028326$$

$$= \frac{25163764\cdot6982934}{13845841}$$

$$= \underline{18\cdot17 \text{ gals. Ans.}}$$

2. PICKWICK.—Find the side of a square inscribed in a semicircle, whose radius is 5 feet.



If BC be a side of the inscribed square, then AB is half a side of the square.

$CB^2 + BA^2 = AC^2$ (I. 47.)
$CB^2 + (\frac{1}{2}\, CB)^2 = 5^2$
$CB^2 + \frac{1}{4}\, CB^2 = 25$
$\frac{5}{4}\, CB^2 = 25$
$CB^2 = \frac{4}{5}$ of 25
$= 20$
$\therefore \underline{CB = \sqrt{20}}$

∴ Side of inscribed square $= 2\sqrt{5}$ ft., or
$\underline{4\cdot472...}$ ft. Ans.

3. ALASCO.—A mirror measuring 33 inches by 22 is to have a frame of uniform width, whose area is to be equal to that of the glass. Find the width.

Area of frame = [{2(33+22) + 4 times width} × width] square inches;

$\therefore$ (110 + 4 times width) × width = × 33 × 22

4 times width^2 + 110 times width = 726

Width^2 + $\frac{55}{2}$ times width = $\frac{363}{2}$

Completing the square } Width^2 + $\frac{55}{2}$ times width + $(\frac{55}{4})^2$ = $\frac{363}{2}$ + $\frac{3025}{16}$

$= \frac{2904 + 3025}{16}$

$= \frac{5929}{16}$

Extracting square root } Width + $\frac{55}{4}$ = $\frac{77}{4}$

$\therefore$ Width = $\frac{77}{4} - \frac{55}{4}$

$= 5\frac{1}{2}$

$\therefore$ Width of frame = $5\frac{1}{2}$ inches.

4. J. N.—Find the area of a segment whose arc contains 245 degrees 45 minutes; the diameter of the circle being 48 ft. 9 in. (*Nesbit's* "Mensuration.")

ft.

48·75

48·75

24375

34125

39000

19500

2376·5625

·7854

95062500

118828125

190125000

166359375

Deg. deg. 166359375

360 : 245$\frac{3}{4}$ :: 1866·6611328 : Area of Sector.

4 4 20·73946875

1445 983 983

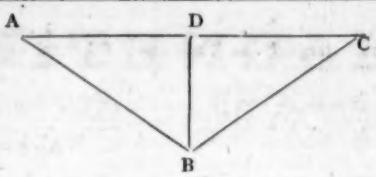
16 6221840625

16591575000

18665521875

16)20386·89778125

1,274·181111328125 sq. ft.



$\angle ABC = 360° - 245\frac{3}{4}° = 114\frac{1}{4}°$,

$\angle ABD = 57\frac{1}{8}°$.

$\frac{AD}{AB} = \sin ABD = \sin 57\frac{1}{8}° = \cdot 8398567$,

$\frac{BD}{AB} = \cos ABD = \cos 57\frac{1}{8}° = \cdot 5428081$;

$\therefore$ AD = ($\cdot 8398567 \times 24\frac{3}{8}$) ft.

= 20·471507 ft.,

BD = ($\cdot 5428081 \times 24\frac{3}{8}$) ft.

= 13·2309474 ft.

Area of $\triangle$ ABC = AD × BD

= 13·2309474

20·471507

926166318

6615473700

132309474

926166318

529237896

26461894 80

270·8574323157318 sq. ft.

$\therefore$ Area of segment = (1,274·181111328125

+ 270·8574323157318) sq. ft.

= 1,545·038543643 8568 sq ft.

[Owing to the pressure on our space by 'Reviews' and 'Advertisements,' we sincerely regret to have to hold over a large number of queries in type.]

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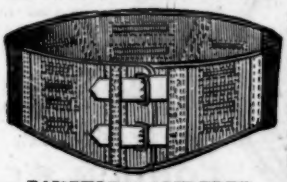

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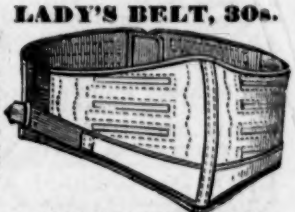

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